# TECHNICAL MANUAL

# OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

## SIGNAL GENERATOR SG-1207/U (HEWLETT-PACKARD MODEL 8642M) (NSN 6625-01-233-8615)

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HEADQUARTERS, DEPARTMENT OF THE ARMY

1 MARCH 1987

**(5) SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK**

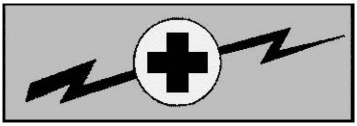
**(1) DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL**

**(2) IF POSSIBLE, TURN OFF THE ELECTRICAL POWER**

**(3) IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL.**

**(4) SEND FOR HELP AS SOON AS POSSIBLE**

**(5) AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION**



**WARNING**

**HIGH VOLTAGE**
is used in the operation of this equipment

**DEATH ON CONTACT**
may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must be warned about dangerous areas.

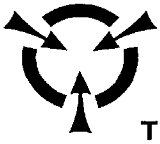
Be careful not to contact high-voltage connections of 115-volt ac input when installing, or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

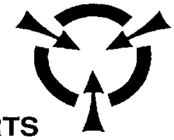
**WARNING**

**Do not be misled by the term "LOW VOLTAGE" Potentials as low as 50 volts may cause death under adverse conditions.**

For Artificial Respiration refer to FM 21-11.



# CAUTION



**THIS EQUIPMENT CONTAINS PARTS AND ASSEMBLIES SENSITIVE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING OR INSERTING PRINTED CIRCUIT BOARDS.**

**ESD**
**CLASS 1**

**NOTE**

**The symbol for static sensitive devices in military inventory is as depicted in the caution block above.**

## GENERAL HANDLING PROCEDURES FOR ESDS ITEMS

- USE WRIST GROUND STRAPS OR MANUAL GROUNDING PROCEDURES
- KEEP ESDS ITEMS IN PROTECTIVE COVERING WHEN NOT IN USE
- GROUND ALL ELECTRICAL TOOLS AND TEST EQUIPMENT
- PERIODICALLY CHECK CONTINUITY AND RESISTANCE OF GROUNDING SYSTEM
- USE ONLY METALIZED SOLDER SUCKER
- HANDLING ESDS ITEMS ONLY IN PROTECTED AREAS

## MANUAL GROUNDING PROCEDURES

- MAKE CERTAIN EQUIPMENT IS POWERED DOWN
- TOUCH GROUND PRIOR TO REMOVING ESDS ITEMS
- TOUCH PACKAGE OF REPLACEMENT ESDS ITEM TO GROUND BEFORE OPENING
- TOUCH GROUND PRIOR TO INSERTING REPLACEMENT ESDS ITEMS

## ESD PROTECTIVE PACKAGING AND LABELING

- INTIMATE COVERING OF ANTISTATIC MATERIAL WITH AN OUTER WRAP OF EITHER TYPE 1 ALUMINIZED MATERIAL OR CONDUCTIVE PLASTIC FILM OR HYBRID LAMINATED BAGS HAVING AN INTERIOR OF ANTISTATIC MATERIAL WITH AN OUTER METALIZED LAYER ·
- LABEL WITH SENSITIVE ELECTRONIC SYMBOL AND CAUTION NOTE

**CAUTION**

**Devices such as CMOS, NMOS, MNOS, VMOS, HMOS, thin-film resistors PMOS, and MOSFET used in many equipments can be damaged by static voltages present in most repair facilities. Most of the components contain internal gate protection circuits that are partially effective, but sound maintenance practice and the cost of equipment failure in time and money dictate careful handling of all electrostatic sensitive components.**

The following precautions should be observed when handling all electrostatic sensitive components and units containing such components.

**CAUTION**

**Failure to observe all of these precautions can cause permanent damage to the electrostatic sensitive device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.**

STEP 1 Turn off and/or disconnect all power and signal source and loads used with the unit.
STEP 2 Place the unit on grounded conductive work surfaces.
STEP 3 Ground the repair operator using a conductive wrist strap or other device using a 1-M series resistor to protect the operator.
STEP 4 Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.
STEP 5 All electrostatic sensitive replacement components are shipped in conductive foam or tubes and must be stored in the original shipping container until installed.
STEP 6 When these devices and assemblies are removed from the unit, they should be placed in the conductive work surface or in conductive containers.
STEP 7 When not being worked on, wrap disconnected circuit boards in aluminum foil or in plastic bags that have been coated or impregnated with a conductive material.
STEP 8 Do not handle these device unnecessarily or remove from their packages until actually used or tested.

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DEPARTMENT OF THEARMY
1 MARCH 1987

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# SIGNAL GENERATOR SG-1207/U (HEWLETT-PACKARD MODEL 8642M) (NSN 6625-01-233-8615)

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5000.

In either case, a reply will be furnished direct to you.

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications, the format has not been structured to consider levels of maintenance.

## TABLE OF CONTENTS

TABLE OF CONTENTS-Continued

## TABLE OF CONTENTS-Continued

**TABLE OF CONTENTS-Continued**

**TABLE OF CONTENTS-Continued**

TABLE OF CONTENTS-Continued

## TABLE OF CONTENTS-Continued

## TABLE OF CONTENTS-Continued

### TABLES



### FIGURES

## TABLE OF CONTENTS-Continued

### FIGURES-Continued

## TABLE OF CONTENTS-Continued

### FIGURES-Continued

# SECTION 0 INTRODUCTION

## 0-1. SCOPE.

This manual contains instructions for the operation and maintenance of Signal Generator SG1207/U. Throughout this manual, the Signal Generator SG-1207/U is referred to as either the Instrument, Signal Generator, 8642, 8642B, or 8642M.

## 0-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

## 0-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

*a Report of Maintenance and Unsatisfactory Equipment*. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750 as contained in Maintenance Management Update.

b. *Report of Packaging and Handling Deficiencies*. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73B/AFR 400-54.MCO 4430.3H.

c. *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy In Shipment Report (SF 361) as prescribed in AR 55-38/NAVSUPINST 1610.33C/AFR 75-18/MCO P4610.19D.DLAR 4500.15.

## 0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR'S).

If your Signal Generator needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, NJ 07703-5000. We'll send you a reply.

## 0-5. ADMINISTRATIVE STORAGE.

Refer to TM 740-90-1 for administrative storage procedures.

## 0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

## 0-7. DESCRIPTION.

The Hewlett-Packard 8642M Signal Generator has a frequency range of from 100KHz to 2GHz and frequency resolution of 1Hz at all frequencies. The output is leveled and calibrated from +15dBm to -140dBm at all frequencies. Amplitude Modulation, Frequency Modulation, and Pulse Modulation modes are selectable. Frequency, modulation modes, output level, and most other functions can be remotely programmed via the interface.

## 0-8. TECHNICAL CHARACTERISTICS.

CONTINUOUS WAVE (CW) SPECIFICATIONS:

Frequency Range with specified RF performance .......... 100KHz to 2000MHz
Frequency Range without specified RF performance .......... 10KHz to 2000MHz
Resolution .......... 1Hz
Display Accuracy .......... ±2 ppm (15° C to 35° C) and +10 ppm (0° C to 50° C)
Frequency Stability:
- Stability vs Time .......... 0.05 ppm/hour and ±2 ppm/90 days
- Stability vs Temperature .......... ±2 ppm (15° C to 35° C) and +10 ppm (0° C to 50° C)
- Stability vs Line Voltage .......... 0.05 ppm for a 10% change in power source voltage
- Stability vs Output Level .......... +0.01 ppm

Spectral Purity:
- Harmonics ... <-25dBc from <+13dBm @ <1057.5MHz and <+7dBm @ >1057.5MHz
- Sub Harmonics .......... <-100dBc (to 1057.5MHz) and <-45dBc (to 2GHz)
- Spurious Signals .......... -70dBc (to 132.1875MHz), -90dBc (132.1875MHz to 1057.5MHz), and -84dBc (above 1057.5MHz) offset >10KHz from carrier
- Residual AM .......... <0.01% AMrms (0.3 to 3 KHz post-detection bandwidth)
- Residual FM .......... <4Hz (to 132.1875MHz),<2Hz (132.1875MHz to 1057.5MHz), and <5Hz (above 1057.5MHz) in a 0.3 to 3KHz post-detection noise bandwidth
- SSB Phase Noise .......... -127dBc/Hz (to 132.1875MHz), -134dBc/Hz (132.1875MHz, 1057.5MHz) and -125dBc/Hz (above 1057.5MHz).measured in a 1Hz bandwidth, offset 20KHz from the carrier
- Noise Floor .......... <-135dBc/Hz (to 132.1875MHz), <-140dBc/Hz (to 1057.5MHz), and <-134dBc/Hz (to 2.0GHz) at 3MHz offset

RF OUTPUT SPECIFICATIONS:
- RF Output Level .......... Carrier level >+15dBm to -140dBm (all frequencies) and +18dbm down to -140dBm (<528.75MHz)
- Output Impedance .......... 50Ω nominal
- Reverse Power Protection .......... 50 watts, 50 volts (to 1000MHz) and 25 watts, 50 volts (above 1000MHz)
- VSWR .......... <1.5:1 (to 1000MHz) and <2.5:1 (above 1000MHz) when terminated in a 50Ω resistive load
- RF Output Connector .......... Female Type N coaxial connector
- Output Level Resolution .......... 0.1dB
- Output Leveling Flatness .......... ±1.5dB (to 500MHz), ±2.0dB (500MHz to 1000MHz), and ±2.5dB (above 1000MHz)
- Attenuator Accuracy .......... ±2.0dB
- Absolute Level Accuracy .......... ≤±0.1dB (-127 to +15dBm) and ≤±3.5dB (<-127 to >+15dBm)

**0-8. TECHNICAL CHARACTERISTICS-Continued.**

MODULATION SPECIFICATIONS:
(Internal and external AM, FM, OM, and Pulse Modulation)

Amplitude Modulation:

Frequency Range ........................................ 100KHz to 1057.5MHz
Modulation Depth .......................... 0% to 99.9% (to 1057.5MHz) in 0.1% increments
Frequency Response ..................... DC to 100KHz external, 20Hz to 100KHz internal
Sensitivity ........................................ 0.1% per mv peak into 600Q
Maximum Input Level ........................................ ±20 volts (30 seconds)
Distortion ............................... <1.5% (30% depth), <3% (30 to 70% depth), and <5% (70 to 90% depth) modulation at a 1KHz rate to 1057.5MHz
Incidental OM .......................... <0.2 radians (30%depth, 1KHz rate, in a 0.3 to 3KHz post-detection noise bandwidth)
Impedance ........................................ 600Ω +10%
AM Input Connector ........................................ Female type BNC coaxial connector

Frequency Modulation:

Frequency Response ...................... DC to 100KHz external,20Hz to 100KHz internal in 1% increments
Deviation ............... ≤300KHz (30MHz to 132.1875MHz), ≤375KHz (132.1875MHz to 528.75MHz), and ≤1.5MHz (above 528.75MHz) for a modulating rate between DC and 100KHz
Sensitivity ................................. 1 volt peak into 600n ±10% for maximum deviation
Maximum Input Level ........................................ ±20 volts (30 seconds)
Distortion ......... 4% (for maximum DC Coupled deviation), 2% (for 1/2 maximum DC Coupled deviation),and 0.4% (for 1/15maximum DC Coupled deviation) for a modulating rate between 20Hz and 100KHz
Incidental AM ................ <0.3% (>400KHz carrier, 20KHz peak deviation, 1KHz rate)
Impedance . ........................................ 600Ω ±10%
FM Input Connector ........................................ Female type BNC coaxial connector

Pulse Modulation:

Operating range ........................................ 10MHz to 2000MHz
Pulse Modulation Input Connector .................... Female Type BNC coaxial connector
Impedance ........................................ 50Ω ±5Ω (10Hz to 200KHz)
Pulse Repetition Rate Range ........................................ DC to 50KHz
Duty Cycle Maximum ........................................ ≥50%
Pulse Duration Range .. 6µsec to 50msec (measured from (DC volts to turn on pulse) to (DC volts turn off pulse))
Pulse First and Last Transition Duration (10% to 90% rise/fall time) 3µsec to 20msec
Pulse Amplitude ........................................ ±3V to ±10V
Pulse Baseline Maximum Amplitude ..................... Less negative than -0.5V and less positive than +0.5V
Pulse Topline Minimum Amplitude ..................... More negative than -3.5V and more positive than +3.5V

**0-8. TECHNICAL CHARACTERISTICS-Continued.**

MODULATION SPECIFICATIONS-Continued:

Pulse Modulation-Continued:

Maximum Input Level ............................................................±20 volts (30 seconds)
RF Pulse Envelope Duration ....................................±5% of the input pulse duration
RF Pulse Envelope First/Last Transition Duration (10%-90% rise/fall time) . <0.5µsec
RF Pulse Envelope Overshoot/Undershoot<20% of the RF pulse envelope amplitude
RF Pulse Envelope first and Last Settling Duration........<1µsec to within ±1% of final value (measured from two 90% points)
RF Pulse Envelope On/Off Ratio.................................. >40dB (10MHz to 2000MHz)

Phase Modulation:

Maximum Deviation ...100 radians (from 100KHz to 132.1875MHz), 25 radians (from 132.1875MHz to 264.375MHz), 50 radians (from 264.375MHz to 528.75MHz), 100 radians (from 528.75MHz to 1057.5MHz), 200 radians (from 1057.5MHz to 2.0GHz)
Bandwidth ........DC to 15KHz external (DC coupled) and 20Hz to 15KHz internal and external (AC coupled)
Resolution ...0.7% of setting or 0.0004% of maximum deviation, whichever is greater
Accuracy .............................................. ±(5% of setting +0.09 radians) at 1KHz rate
Distortion.......................................................................... <0.4% at 1KHz rate
External Sensitivity..............................1 volt peak for selected peak phase deviation
Maximum Input Level ............................................................±15 volts (30 seconds)
Impedance .....................................................................50Ω +5Ω (10Hz to 200KHz)
∅M Input Connector ..........................................Female type BNC coaxial connector

Internal Modulation Oscillator:

Frequency Range: ...................................................................... 20Hz to 100KHz
Frequency Resolution:...................................................................... 1% of setting
Frequency Accuracy:......................................................................... 2% of setting
Output Level Range: ......................................................0 to 3 volts peak into 600Ω
Output Level Resolution: .......................................................................................... 4mV
Output Level Accuracy (within 1 sec):...................................................±(4%+15mV)
Distortion (>0.5V peak):.... <0.02% (20Hz to 15.8KHz), <0.15% (15.8KHz to 100KHz)
Output Impedance:....................................................................................... 600Ω
Output Connector ............................................Female type BNC coaxial connector

REAR PANEL CONNECTOR SPECIFICATIONS:

Interface Connector:

Type...............ANSI/IEEE Standard 488-1978 interface with SH1, AH1, T1, 2 5, or 6, L1, 2, 3, or 4, SR1, RL1, PPO, DC1, ETO, and CO functions implemented
Control ................ All front panel functions, except power switch and increment knob, may be controlled through the interface
X-Axis Connector.........................................................................0-10Vdc, ±10%
Z-Axis Connector................TTL positive true for CRT display blanking during retrace
External Reference Input .................. 1,2,5 or 10MHz, ±25ppm, >0.5p-p 500Ω input
10MHz Output .............................10MHz, >1.4Vp-p into 50Ω, 75Ω impedance output

**0-8. TECHNICAL CHARACTERISTICS-Continued.**

OPERATING POWER REQUIREMENTS:

Voltage .......... 115/230 VAC
Frequency .......... 50 to 400Hz
Power Dissipation .......... 300VA maximum

ENVIRONMENTAL REQUIREMENTS:

Operating Temperature Range .......... 0 to +55°C
Operating Altitude .......... <4570 meters (15,000 feet)
Operating Humidity .......... 5 to 95% at 40°C

OVERALL DIMENSIONS AND WEIGHT:

Height .......... 5.25 IN. (133mm)
Width .......... 16.75 IN. (425mm)
Depth .......... 23.8 IN. (617mm)
Weight .......... 71.5LB (32.7kg) NET

ACCESSORIES FURNISHED:

Power Cable, 115V operation .......... 1 each HPN 8120-1378
Fuse, 230V operation .......... 1 each HPN 2110-0002
Fuse, 115V operation .......... 1 each HPN 2110-0003
Front Handle Kit .......... 1 each HPN 5061-9689

**0-9. STORAGE.**

The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature .......... -55°C to +75°C
Humidity .......... 5% to 95% (maximum wet-bulb temperature = 40°C)
Altitude .......... 50,000 feet (15,300 meters)

**0-10. TOOLS AND TEST EQUIPMENT CROSS REFERENCE.**

The following list of test equipment is required for testing, and servicing the Signal Generator.

| INSTRUMENT | CRITICAL SPECIFICATION | MODEL NUMBER |
|---|---|---|
| Digital Voltmeter | 10mV to 600V, ±-05% of reading ±1 digit | HP 3490 |
| Digital Multimeter | No substitute | JF 8020A |
| Oscilloscope Mainframe | See Plug-in Oscilloscope | TEK 5440 |
| Plug-In Oscilloscope | 10mV/div, 100MHz BW | TEK 5S14N |
| Probe | 10:1 | TEK P6056 |
| Power Meter | 10MHz to 2GHz, -27 to +7dBm ±1% | HP 432A |

| INSTRUMENT | CRITICAL SPECIFICATION | MODEL NUMBER |
|---|---|---|
| Thermistor Mount | 10MHz to 2GHz, -27 to +7dBm +1% | HP 478A |
| Attenuator, Set | 450KHz to 2GHz, 10dB, $\pm$0.1dB, <1.3 SWR | WE-9918 |
| Spectrum Analyzer | No substitute | TEK 492/1/2/3/21 |
| Pulse Generator | 50KHz max rate, <6µsec PW, <100nsec rise time | HP 214B |
| Modulation Analyzer | No substitute | HP 8901A |
| Distortion Analyzer | 0-5% AM, 0-2% FM distortion 0-4vpeak input | HP 334A |
| Frequency Measurement System | 0-2GHz, $\pm$1Hz | HP 5345A System |
| Low Frequency Spectrum Analyzer | 100Hz to 40MHz,<10Hz RES BW, 90dB dynamic range | HP 3585A |
| Adapter | BNC to type N | UG-201A/U |
| Adapter | BNC to dual banana | POM 1656-2-60075 ohm |
| Cable Assembly | 502 BNC-BNC (2 each)0 | POM BNC-C-3 |
| BNC Tee | | UG-274 |
| Test Conn | BD ASSY PS TEST CONN | HP 08642-80053 |
| Cable Assembly | Flat | HP 08642-60959 |
| Cable Assembly | Long | HP 08662-60075 |
| Cable Assembly | Short | HP 08662-60080 |
| Adapter | (M) SMC to (M) SMC (4) | HP 1250-0827 |
| Adapter | (F) BNC to (F) SMC (2) | HP 1250-0832 |
| Adapter | (M) SMC TEE | HP 1250-0837 |
| Adapter | (M) SMA to (F) SMC (2) | HP 1250-1697 |
| Adapter | 50 Pin Test Connector | HP 1251-5653 |
| Adapter | 16 Pin Test Connector | HP 1251-8105 |
| Adapter | 26 Pin Test Connector | HP 1251-8248 |
| Adapter | 34 Pin Test Connector | HP 1250-8601 |
| Adapter | 20 Pin Test Connector | HP 1251-8812 |
| Adapter | 14 Pin Test Connector | HP 1251-8823 |
| Adapter | 10 Pin Test Connector | HP 1252-0153 |
| Adapter | Binding Post | HP 5021-0844 |
| Test Lead Kit | | HP 34118A |

**0-11. WARRANTY INFORMATION.**
The HP 8642 is warranted by Hewlett-Packard Company for 1 year. Warranty starts on the date of shipment to the original buyer. Report all defects in material or workmanship to your supervisor who will take appropriate action.

**0-12. SAFETY CONSIDERATIONS.**
This product is a Safety Class I instrument; that is , one provided with a protective earth terminal. Before operating or servicing the Signal Generator, personnel should familiarize themselves with both the safety markings on the equipment and the safety information presented at the beginning of this manual.

## SECTION I. OPERATING INSTRUCTIONS

### 1-1. DESCRIPTION AND USE OF OPERATOR'S CONTROLS, INDICATORS, AND CONNECTORS.

This paragraph describes all of the operator controls and indicators for the Signal Generator. Due to the large number of controls and indicators on the front panel, it is necessary to separate the panel into five different portions. Figure 1-1 (views A thru E) shows each portion of the front panel. The rear panel is shown in figure 1-2.

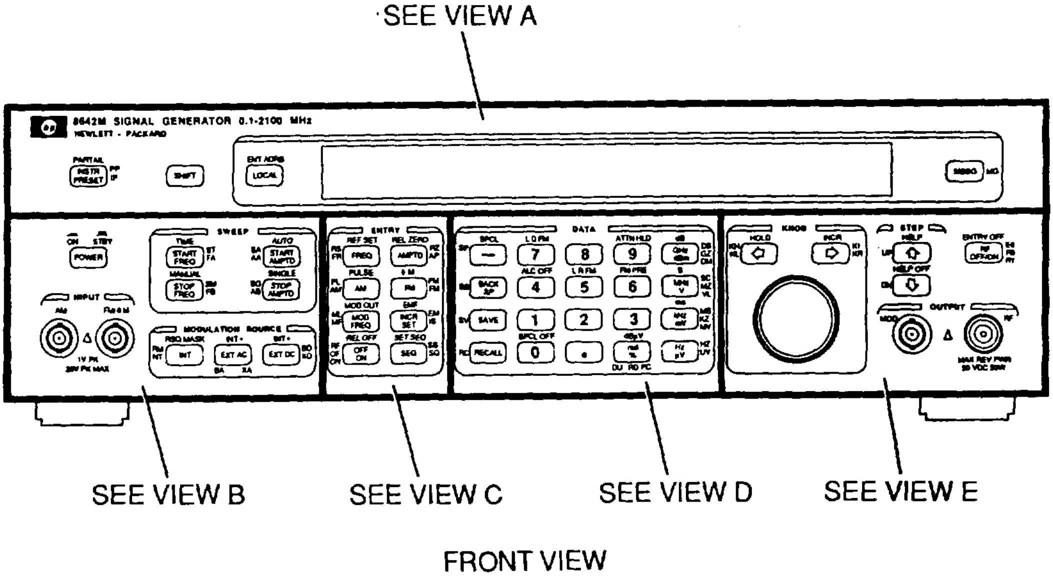
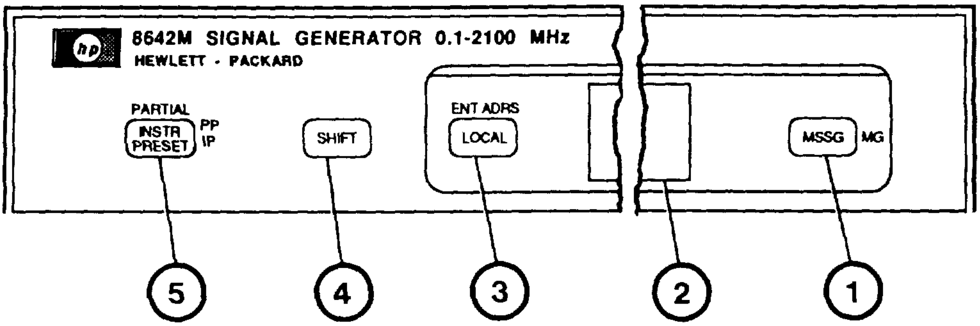



Figure 1-1. Operator's Controls, Indicators, and Connectors, front view.

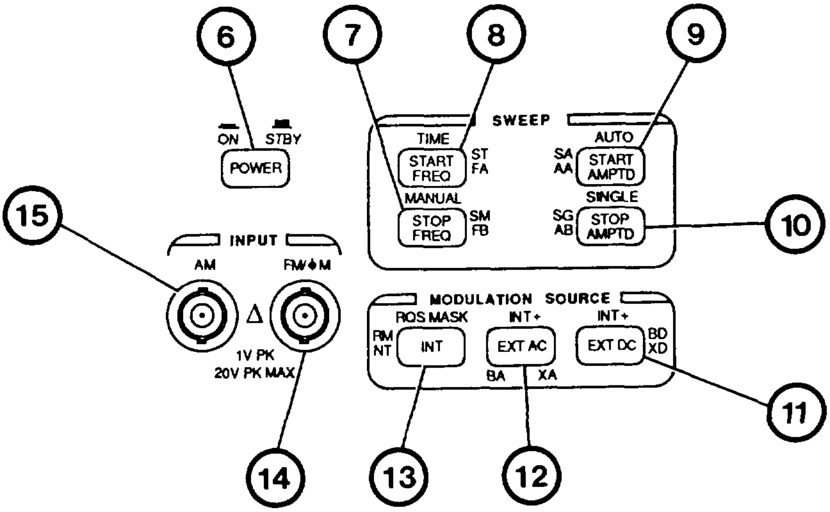



VIEW A

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 1 | MESSAGE push button | When pressed, queued-up operating messages are displayed. MSSG annunciator and flashing display are indications that messages are present. Press SHIFT MESSAGE push buttons to view previous messages. |
| 2 | Display | Displays various Signal Generator messages and settings. The cursor designates which Signal Generator function is active |
| | RMT LSTN TLK SRQ | These annunciators indicate the HP-IB status of the Signal Generator. |
| | START annunciator | Indicates that RF frequency sweep is selected and a start frequency is currently displayed or that a sequence is being set. |
| | FREQ annunciator | Indicates the RF frequency is being displayed. |
| | REL annunciator | Indicates the current RF frequency is displayed in relative units |
| | EMF annunciator | Indicates the current amplitude is in EMF units. |
| | SPCL annunciator | Indicates a special function is currently selected. |
| | SWPNG annunciator | Indicates that either an RF frequency or amplitude sweep is currently taking place. |
| | HILO annunciators | Used to indicate whether the external modulation source level is too high or too low to obtain the displayed depth or deviation. Reference level is 1V peak, $\pm$5%. Not used for pulse modulation. |
| | OM FM AM annunciators | Indicate the type or types of modulation selected. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| | START annunciator | When the START annunciator in the left portion of the display appears with the AMPTD annunciator, a start amplitude is currently displayed. When this annunciator appears without the AMPTD annunciator, a sequence is being set. |
| | INT EXT AC DC | Combinations of these annunciators display the current status of the modulation source for the displayed modulation type. |
| | AMPTD annunciator | Indicates that the output amplitude is being displayed. |
| | REL annunciator | Indicates the current output amplitude is displayed in relative units. |
| | STOP annunciator | Indicates that:<br>1) stop frequency of the RF frequency sweep is currently being displayed, or<br>2) stop amplitude of amplitude sweep is currently being displayed, or<br>3) that sequence is being set. |
| | MSSG annunciator | When displayed, select the Message push button to display a queued-up message. |
| 3 | LOCAL push button | Used only when external controller is connected to Signal Generator. When used, Signal Generator is switched out of remote operation. |
| 3A | ENT ADRS | Used to display or change address. Press SHIFT then LOCAL to display present address. Press SHIFT, LOCAL, desired number from 00 to 30, then HZ µV push buttons to enter new address. |
| 4 | SHIFT push button | Allows for access to the functions labeled in blue. To bypass the power-up checks, press and hold SHIFT push button down during power-up until instrument settings are displayed. Pressing Shift twice clears any messages and returns the display to showing normal instrument settings. |
| 5 | INSTR PRE SET | Sets the Signal Generator to an initialized state. Push for on. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 5A | PARTIAL | Sets the Signal Generator to another initialized state without affecting certain instrument settings. RF Frequency, Amplitude Reference, EMF Mode, and Sweep Mode are not affected. AM Depth, FM Deviation, Phase Deviation, Pulse Modulation, Modulation Output Level, Start Frequency, Stop Frequency, Frequency Reference, Start Amplitude, and Stop Amplitude are turned off but previously entered values remain. Push Shift then INSTR PRE SET for on. |



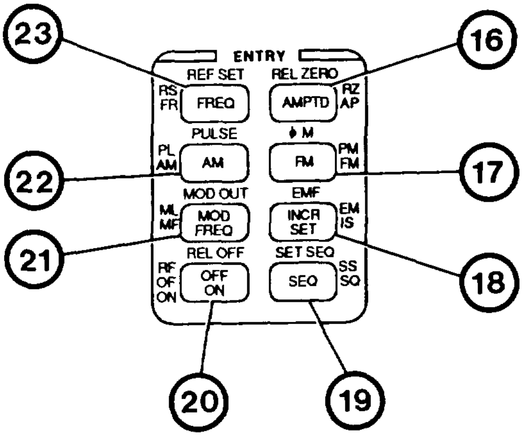

**VIEW B**

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 6 | POWER switch | Changes Signal Generator from standby to on. Push in for on and push in again for standby. |
| 7 | STOP FREQ push button | Used to enter or display a stopping frequency in sweep mode. Press to display present stop value in the display. Press and use data entry push buttons to enter a new stop frequency. Stop frequency may be less than or greater than start frequency. |
| 7A | MANUAL | Used to activate sweep circuitry, but does not start a sweep. TUNE knob or the STEP push buttons control frequency/amplitude sweep. Beginning frequency/ amplitude is controlled by START push button, ending frequency/amplitude is controlled by STOP push button, and step size is controlled by TIME push button. Sweep time of each step is controlled by operator. Press SHIFT then STOP FREQ push button to activate. |
| 8 | START FREQ push button | Used to enter or display a starting frequency in sweep mode. Press to display present start value in the display. Press and use data entry push buttons to enter a new start frequency. Start frequency may be less than or greater than stop frequency. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 8A | TIME | Used to enter and display time interval between START FREQ to STOP FREQ or START AMPTD to STOP AMPTD. Press SHIFT and hold START FREQ to show present time value in display. To enter a new time, press SHIFT, START FREQ push button, enter desired time using data entry push buttons, and press MHz V (sec) or KHz mV (msec) push button. Allowable values for frequency time range are 275msec (5msec for phase continuous sweep) to 999sec in 1msec increments. The minimum calculated step size is 1Hz. Allowable values for amplitude time range are 20msec to 999sec in 1msec increments. The minimum calculated step size is 0.1dB. |
| 9 | START AMPTD push button | Used to enter or display a starting amplitude in sweep mode. Press to display present start value in the display. Press and use data entry push buttons to enter a new start amplitude. Start amplitude may be less than or greater than stop amplitude. |
| 9A | AUTO | Used to start frequency/amplitude sweep, restarting at end of each sweep. Beginning frequency/amplitude is controlled by START push button, ending frequency/amplitude is controlled by STOP push button, and sweep time is controlled by TIME push button. Press SHIFT then START AMPTD push button to activate. |
| 10 | STOP AMPTD push button | Used to enter or display a stopping amplitude in sweep mode. Press to display present stop value in the display. Press and use data entry push buttons to enter a new stop amplitude. Stop amplitude may be less than or greater than start amplitude. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 10A | SINGLE | Used to start frequency/amplitude sweep, stopping at end of each sweep. After one complete sweep, all values remain at stopping point value. Beginning frequency/amplitude is controlled by START push button. Ending frequency/amplitude is controlled by STOP push button. Sweep time is controlled by TIME push button. Press SHIFT then STOP AMPTD push button to activate. |
| 11 | EXT DC push button | Selects an external, dc-coupled signal to modulate the Signal Generator RF Output. External signal is connected to AM/PULSE/FM/OM connector. Push for on. |
| 11A | INT + (EXT DC) | Selects an external, dc-coupled signal and internal modulation oscillator signal to be summed together to modulate the Signal Generator RF Output. |
| 12 | EXT AC push button | Selects an external, ac-coupled signal to modulate the Signal Generator RF Output. External signal is connected to AM/PULSE/FM/OM connector. Push for on. |
| 12A | INT + (EXT AC) | Selects an external, ac-coupled signal and internal modulation oscillator signal to be summed together to modulate the Signal Generator RF Output. |
| 13 | INT push button | Selects Signal Generator internal modulation oscillator to modulate the RF Output. Push for on. |
| 13A | RQS MASK | Used for remote operation only. Displays or changes service request status byte value. Press SHIFT then INT push button to display present value. Press SHIFT, INT, desired decimal number from 0 to 255, then HZ µV push buttons to enter new value. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 14 | FM/OM connector | BNC female connector with 600 ohms input impedance used to connect an externally supplied DC to 100KHz, 1 volt peak ±5% signal for frequency modulation of Signal Generator RF output. FM deviation is selectable from 300KHz to 1.5MHz for a 1 volt peak signal. Also used for phase modulation. |
| 15 | AM connector | BNC female connector with 600 ohms input impedance used to connect an externally supplied DC to 100KHz, 1 volt peak ±5% signal for amplitude modulation of Signal Generator RF output. AM Depth is selectable from 0 to 99.9% with 1 volt peak signal. |




VIEW C

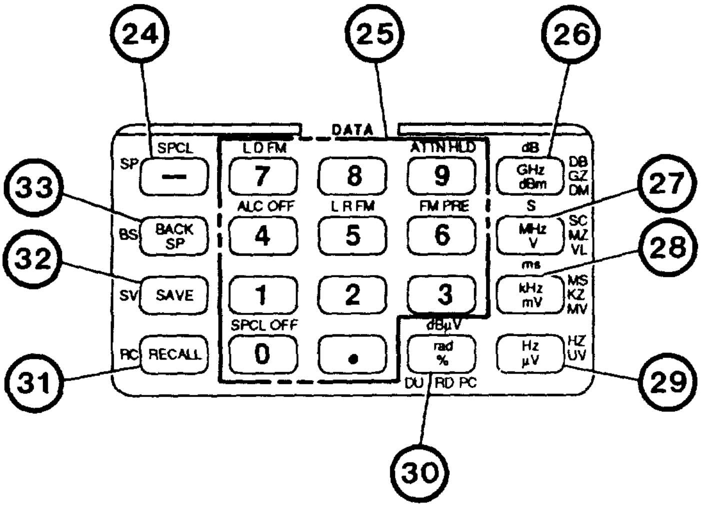
| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 16 | AMPTD push button | Used to enter an output amplitude level. Push and use either data entry push buttons, TUNE KNOB, STEP push buttons, or the OFF ON push button to enter a new amplitude. New value may be entered in dBm, V, mV, µV, or dBµV (RAD % push button). Amplitude is shown with a cursor above display indicating it is the active function. |
| 16A | REL ZERO | Used to store the current RF output frequency/amplitude setting as the new frequency/amplitude reference. After pressing, display will show 0MHz/0dB. All subsequent frequency/amplitude settings will be entered and displayed as MHz/dB relative to the stored frequency/amplitude reference value. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 17 | FM push button | Used to activate frequency modulation mode. When using internal source, push FM then INT to activate internal modulation oscillator. Push FM and use either data entry push buttons, TUNE KNOB, STEP push buttons, or the OFF ON push button to enter a FM deviation in GHz, MHz, KHz, or Hz. When external signal source is used for FM mode, press FM and enter FM deviation in GHz, MHz, KHz, or Hz for a 1 volt peak signal applied to FM connector. Actual FM deviation is controlled by amplitude of input signal and FM deviation selection. FM deviation is shown with a cursor above display indicating it is the active function. May be used simultaneously with either AM or Pulse Modulation. |
| 17A | PHASE (OM) | Used to activate Phase modulation mode. When using internal source, push SHIFT FM then INT to activate internal modulation oscillator. Push SHIFT FM and use either data entry push buttons, TUNE KNOB, STEP push buttons, or the OFF ON push button to enter a OM deviation from 0 to 100 radians. When external signal source is used for OM mode, press SHIFT FM and enter 0 to 100 radians for a 1 volt peak signal applied to OM connector . Actual OM deviation is controlled by amplitude of input signal and OM deviation selection. OM deviation is shown with a cursor above display indicating it is the active function. May be used simultaneously with either AM or Pulse Modulation. |
| 18 | INCR SET push button | Used to enter a new increment value or display a previously stored increment value. Push to display stored increment. Press and use numeric push buttons to enter a new increment. TUNE KNOB or STEP push buttons can increase or decrease selected functions by INCR SET stored value. Both frequency and amplitude functions can be entered. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 18A | EMF | The EMF mode enables you to display and enter amplitude values in EMF units. Press SHIFT, INCR SET, then OFF ON push button to activate EMF mode. The EMF amplitude is set by selecting the desired AMPTD function. |
| 19 | SEQ push button | The SEQ push button enables you to sequentially step through the recall registers in ascending sequence. Range is determined by SET SEQ. |
| 19A | SET SEQ | Used to select a particular range of recall registers to be viewed. Press SHIFT SEQ push buttons and enter desired start and stop registers from 00 to 50. |
| 20 | OFF ON push button | The OFF ON push button toggles an active function off or on with a single push button stroke. When OFF ON is used to activate a function, it turns on to the default value or value previously stored. The OFF ON push button can also be used to turn on or turn off the EMF mode, a Reference Set value, the Knob Hold mode, or the Help mode (off only). |
| 20A | REL OFF | Used to turn off Frequency/Amplitude Relative Mode. Press SHIFT OFF ON. |
| 21 | MOD FREQ push button | Used to enter a Modulation frequency when using internal modulation oscillator in AM, FM, and OM modulation modes. MOD connector output frequency is also entered by MOD FREQ push button. Push and use either data entry push buttons, TUNE KNOB, STEP push buttons, or the OFF ON push button to enter a new modulation frequency. New value may be entered in KHz or Hz. Modulation frequency is shown in display. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 21A | MOD OUT | Used to control the output level from the MOD connector. Press SHIFT MOD FREQ push buttons and enter an output level from 0 to 3Vpk using either data entry push buttons, TUNE KNOB, STEP push buttons, or the OFF ON push button Modulation output level is shown with a cursor above display indicating it is the active function. |
| 22 | AM push button | Used to activate amplitude modulation mode. When using internal source, push AM then INT to activate internal modulation oscillator. Push AM and use either data entry push buttons, TUNE KNOB, STEP push buttons, or the OFF ON push button to enter a modulation depth from 0 to 99.9%. When external signal source is used for AM mode, press AM and enter 0% to 99.9% full scale modulation for a 1 volt peak signal applied to AM connector . Actual AM depth is controlled by amplitude of input signal and AM depth selection. Depth is shown with a cursor above display indicating it is the active function. May be used simultaneously with either FM or Phase Modulation. |
| 22A | PULSE | Used to activate Pulse modulation mode. When using internal source, push SHIFT, AM then INT to activate internal modulation oscillator. When using external signal source, press SHIFT AM then EXT DC push buttons. Press SHIFT AM, and OFF ON push buttons to activate mode. Trigger voltage is $\pm$1.5 volts. |
| 23 | FREQ push button | Used to enter an RF frequency. Push and use either data entry push buttons, TUNE KNOB, STEP push buttons, or the OFF ON push button to enter a new frequency. New value may be entered in GHz, MHz, KHz, or Hz. Frequency is shown with a cursor above display indicating it is the active function. |

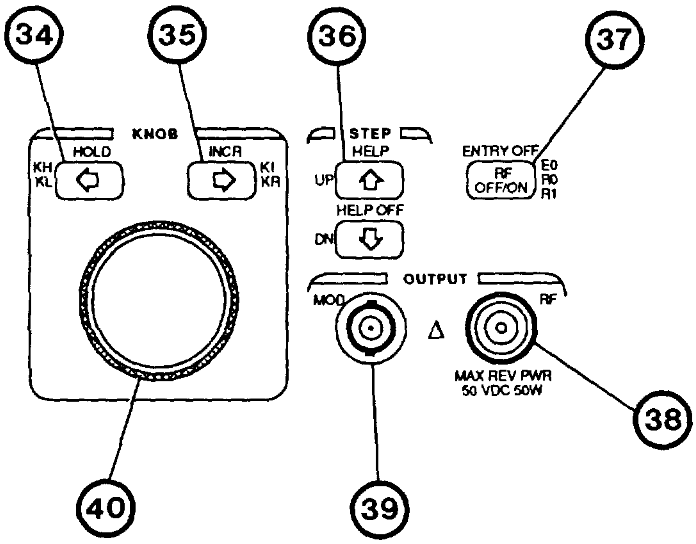
| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 23A | REF SET | Used to enter or display the frequency/amplitude reference. Press SHIFT, FREQ to display present value. Press SHIFT, FREQ, and using the data entry push buttons, enter the new frequency/amplitude reference value. Displayed value will be offset from the stored frequency/amplitude reference value. All subsequent settings will be entered and displayed as offset from the stored frequency/amplitude reference value. |




**VIEW D**

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 24 | - push button | Used to enter negative numeric value for all Signal Generator Functions. Push for minus. |
| 24A | SPCL | Used to select special functions. Push SHIFT SPCL push button, followed by a valid special function number. (All of the single-digit special functions are labeled in light grey print above digit push buttons.) |
| 25 | Numeric push buttons | Used to enter numeric value with decimal point for all Signal Generator Functions. After data is entered, terminator push buttons (KHz mV, etc) are pressed to enter value. Press desired push button. |
| 26 | GHz dBm push button | Used to internally store entries from numeric push buttons. Frequency functions are assigned GHz. Amplitude functions are assigned dBm/dB (REF/EMF). Push for on. |
| 27 | MHz V push button | Used to internally store entries from numeric plush buttons. Frequency functions are assigned MHz. Amplitude functions are assigned volts. Time functions are assigned seconds. Push for on. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 28 | kHz mV push button | Used to internally store entries from numeric push buttons. Frequency functions are assigned kHz. Amplitude functions are assigned millivolts. Time functions are assigned milliseconds. Push for on. |
| 29 | Hz µV push button | Used to internally store entries from numeric push buttons. Frequency functions are assigned Hz. Amplitude functions are assigned microvolts. Push for on. |
| 30 | rad % push button | Used to internally store entries from numeric push buttons. ∅M (Phase modulation) is assigned radians. AM depth is assigned percent. Amplitude functions are assigned dbµV. Push for on. |
| 31 | RECALL push button | Used to recall a previously stored Signal Generator operational setup. When selected, front panel settings change to recalled settings. Push RECALL and register number (00 thru 50) to recall a stored setup. |
| 32 | SAVE push button | Used to store a Signal Generator operational setup. All front panel controls and indicators, except Messages, HP-IB Address, Local/Remote Mode, Sequential settings, and Special functions can be stored. Push SAVE and register number (00 thru 50) or STEP push buttons to store a setup. |
| 33 | BACK SP push button | Clears one digit at a time starting with least significant digit and is used only during data entry and before any terminator push button is pressed. |




**VIEW E**

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 34/35 | → ←push buttons | Used to select desired digit to be modified by positioning cursor in display. If cursor positioned over 3rd digit, knob will increment/decrement 3rd digit. → moves cursor to right, ← moves cursor to left. Will not move cursor from one function to another (frequency to amplitude). Push to move. |
| 34A | HOLD | Used to maintain TUNE KNOB control over one function, while allowing any other function to be controlled by STEP or data entry push buttons. Dual cursors indicate the function that is controlled by the TUNE KNOB while a single cursor indicates the function controlled by STEP or data entry push buttons. Push SHIFT, ←, OFF ON to activate. |
| 35A | INCR | Used to set the TUNE KNOB increment to the value entered and stored as INCR SET. Press SHIFT → to transfer the increment value to the TUNE KNOB. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 36 | STEP (UP/DOWN) push buttons | Used to vary values shown with cursor in display. UP push button increases value and DOWN push button decreases value. Step size is determined by default value or value previously stored in INCR SET. Frequency, Start Frequency, Stop Frequency, Amplitude, Start Amplitude, Stop Amplitude, AM Depth, FM Deviation, ∅M Deviation, Modulation Frequency, Modulation Output, Sweep Time, Manual Sweep, Save, Recall, and Help can be controlled by the STEP push buttons. Press for on. Press and hold to repeat. |
| 36A | HELP | The Help function enables you to display the numbers and descriptions of special functions. Press SHIFT STEP (UP) push button to activate, SHIFT STEP (DOWN) push button to deactivate. |
| 37 | RF OFF/ON push button | Used to turn RF OUTPUT connector on or off. Provides a convenient and rapid way to toggle the RF Output off and on without changing the attenuators. When RF output is on, Signal Generator has a normal RF signal at RF OUTPUT connector |
| 37A | ENTRY OFF | Used to disable the active function as well as all TUNE KNOB related functions. When activated, display will not show cursors. TUNE KNOB and STEP push buttons will not change displayed values. Press SHIFT RF OFF/ON to activate. |
| 38 | RF OUTPUT connector | Type N female connector with output impedance of 50 ohms used to connect Signal Generator to a load. Supplies RF output over entire frequency range of 100KHz to 2.0GHz. Reverse power protection up to 50 W. |
| 39 | MOD connector | Used to supply a 20Hz to 100KHz sinewave signal for modulation. Output level is 0 to 3V peak. Output impedance is 600Ω. Leave open for normal operation. Connector mates with BNC plug. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 40 | TUNE KNOB | Used to vary values shown with cursor in display. Clockwise rotation increases value and counterclockwise rotation decreases value. Step size is either determined by value stored in INCR SET or cursor positioning push buttons. Frequency, Start Frequency, Stop Frequency, Amplitude, Start Amplitude, Stop Amplitude, AM Depth, FM Deviation, ∅M Deviation, Modulation Frequency, Modulation Output, Sweep Time, Manual Sweep, and Help can be controlled by the TUNE KNOB. |

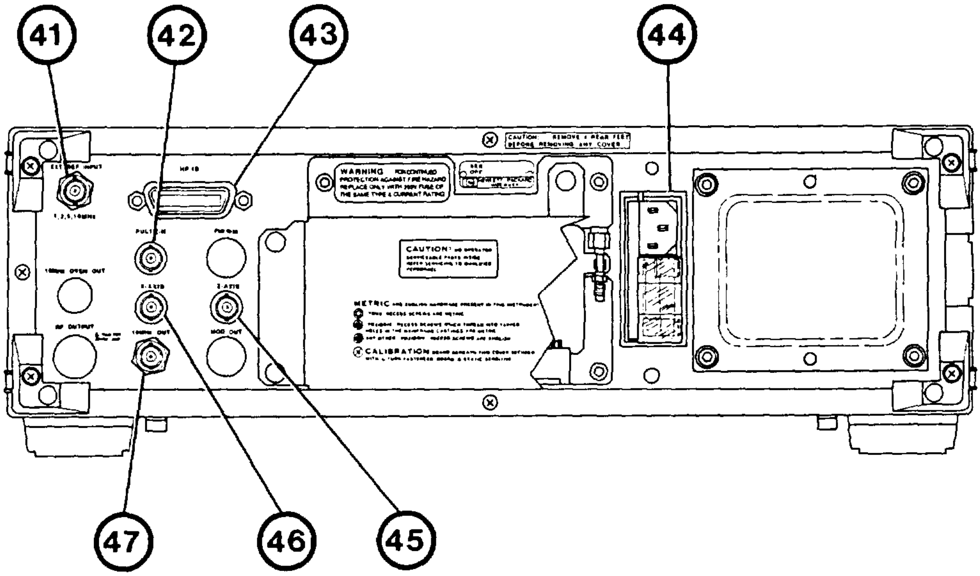



**Figure 1-2. Operator's Controls, Indicators, and Connectors, rear view.**

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 41 | EXT REF INPUT connector | Used to connect a 1,2 , 5, or 10Mhz external reference to Signal Generator. Input power can be no less than 0.5Vp-p. Maximum input is ±5 volts. Leave open for normal operation. Impedance is 500Ω. Connector mates with BNC plug. |
| 42 | Pulse connector | BNC female connector with 50 ohms input impedance used to connect an externally supplied DC to 50KHz, 1 to 15 volt peak signal for pulse modulation of Signal Generator RF output. Trigger voltage is 1.5 volts. Accepts TTL levels. |
| 43 | HPIB Interface connector | Used as input and output connector for external devices during remote operation. Connector has 24 pins with metric posts. |

| KEY | CONTROL, INDICATOR, OR CONNECTOR | FUNCTION |
|---|---|---|
| 44 | Line Power Module | Used as power input connector for Signal Generator. Also contains line fuse and voltage selection facilities. Voltage selection provided for operation from 100, 120, 220, or 240 VAC. Number visible in window displays nominal line voltage for which the Signal Generator is set to operate. Power input connector accepts female end of power cable (supplied). Protective grounding conductor connects to Signal Generator through this connector. Line power fuse is 3 amp, 250 volts for 100/120 VAC operation and 2 amp, 250 volts for 220/240 VAC operation. Remove power cable, slide plastic window over connector, and pull extractor to remove fuse. |
| 45 | Z-Axis connector | Connection providing a TTL positive true blanking pulse for external oscilloscope display blanking during retrace. Leave open for normal use. Connector mates with BNC plug. |
| 46 | X-Axis connector | Connection providing a 0 to 10Vdc ±10% voltage stepped output for use with an external oscilloscope. Leave open for normal use. Connector mates with BNC plug. |
| 47 | 10MHz connector | Used for a signal reference to synchronize external devices to Signal Generator. Output power is >1.4Vp-p at 50Ω. Output frequency is 10MHz. Output impedance is 75Ω. Leave open for normal operation. Connector mates with BNC plug. |

## 1-2. INSTALLATION.

The following paragraphs provide the information needed to install the HP 8642 Synthesized Signal Generator. Included is information pertinent to initial inspection, power requirements, line voltage selection, power cables, interconnection, and environment.

## 1-3. INITIAL INSPECTION.

**WARNING**

**To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers and panels).**

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are given in Section VI. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection.

## 1-4. PREPARATION FOR USE.

### Power Requirements

The Signal Generator requires a power source of 100 Vac (90 to 105 Vac), 120 Vac (108 to 126 Vac), 220 Vac (198 to 231 Vac), or 240 Vac (216 to 252 Vac), 47.5 to 440 Hz single phase. Power consumption is 260 VA maximum (270 VA during attenuator switching).

**WARNING**

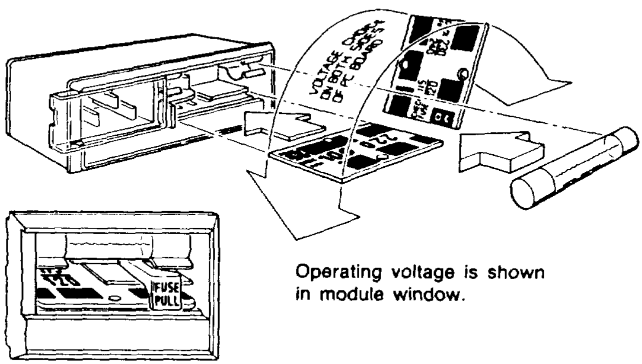
**This is a Safety Class 1 product (i.e., provided with a protective earth terminal). An uninterruptible safety earth ground must be provided from the power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.**

If this instrument is to be energized via an external autotransformer for voltage reduction, make sure that the common terminal is connected to the earthed pole of the power source.

**CAUTION**

**BEFORE PLUGGING THIS INSTRUMENT into the Line voltage, be sure the correct voltage and fuse have been selected.**

A rear-panel, line power module permits operation from 100, 120, 220, or 240 Vac. The number visible in the window (located on the module) indicates the nominal line voltage to which the instrument must be connected. Verify that the line voltage selection card and the fuse are matched to the power source. Refer to Figure 1-3, Line Voltage and Fuse Selection.




**Selection of Operating Voltage**

1. Open cover door, pull the FUSE PULL lever and rotate to left. Remove the fuse.
2. Remove the Line Voltage Selection Card. Position the card so the line voltage appears at top-left corner. Push the card firmly into the slot.
3. Rotate the FUSE PULL lever to its normal position. Insert a fuse of the correct value in the holder. Close the cover door.

**Figure 1-3. Line Voltage and Fuse Selection.**

Two fuses are supplied with each instrument. One fuse has the proper rating for 110/120 Vac line operation (HP part number 2110-0003; 3A, 250V, non-time-delay). The other fuse is rated for 200/220 Vac operation (HP part number 2110-0002; 2A, 250V, non-time-delay).

One fuse is installed in the instrument at the time of shipment. The rating of the installed fuse is selected according to the line voltage specified by the customer. If the voltage is not specified, the rating of the installed fuse will be selected according to the country of destination.

**WARNING**

**For protection against fire hazard, the line fuse should only be a 250V normal blow fuse with the correct current rating.**

**Power Cables**

**WARNING**

**BEFORE CONNECTING THIS INSTRUMENT, the protective earth terminal of the instrument must be connected to the protective conductor of the line power cord. The line plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two conductor outlet is not sufficient protection.**

This instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to Table 1-1 for the part numbers of the power cables and line plugs available.

**HP-IB Address Selection**

The Signal Generator's address is set to 19 at the factory both in RAM memory and an internal switch located inside the instrument. The address stored in RAM remains valid through switching the power from standby to on and unplugging of the ac power cord (unless the internal battery power is lost which would cause RAM memory to be lost).If RAM memory is ever lost, the address on the internal switch is read and becomes the address at turn on. Refer to HP-IB operation for procedures to set the Signal Generator's HP-IB address.

**Interconnections**

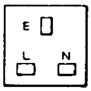
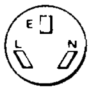
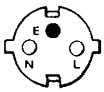
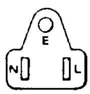
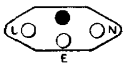
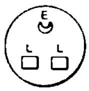
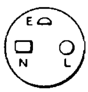
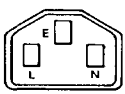
Interconnection data for the Hewlett-Packard Interface Bus is provided in Figure 1-4, Hewlett-Packard Interface Bus Connections.

**Mating Connectors**

Interface Connector. The HP-IB mating connector is shown in Figure 1-4. Note that the two securing screws are metric.

Coaxial Connectors. Coaxial mating connectors used with the Signal Generator should be either the 50-ohm BNC male connectors or 50-ohm Type-N male connectors that are compatible with those specified in US MIL-C-39012.

Table 1-1. AC Power Cables Available

| Plug Type | Cable HP Part Number | C D | Plug Description | Cable Length (inches) | Cable Color | For Use In Country |
|---|---|---|---|---|---|---|
| 250V  | 8120-1351<br>8120-1703 | 0<br>6 | Straight*BS1363A<br>90° | 90<br>90 | Mint Gray<br>Mint Gray | United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore |
| 250V  | 8120-1369<br>8120-0696 | 0<br>4 | Straight*NZSS198/ASC112<br>90° | 79<br>87 | Gray<br>Gray | Australia, New Zealand |
| 250V  | 8120-1689<br>8120-1692 | 7<br>2 | Straight*CEE7-Y11<br>90° | 79<br>79 | Mint Gray<br>Mint Gray | East and West Europe, Saudi Arabia, Egypt, So. Africa, India (unpolarized in many nations) |
| 125V  | 8120-1378<br>8120-1398<br>8120-1754<br>8120-1378<br>8120-1521<br>8120-1676 | 5<br>5<br>7<br>1<br>6<br>2 | Straight*NEMA5-15P<br>90°<br>Straight*NEMA5-15P<br>Straight*NEMA5-15P<br>90°<br>Straight*NEMA5-15P | 80<br>80<br>36<br>80<br>80<br>36 | Black<br>Black<br>Black<br>Jade Gray<br>Jade Gray<br>Jade Gray | United States, Canada, Japan (100V or 200V), Mexico, Phillipines, Taiwan |
| 250V  | 8120-2104 | 3 | Straight*SEV1011<br>1959-24507<br>Type 12 | 79 | Gray | Switzerland |
| 250V  | 8120-0698 | 6 | Straight*NEMA6-15P | | | United States, Canada |
| 220V  | 8120-1957<br>8120-2956 | 2<br>3 | Straight*DHCK107<br>90° | 79<br>79 | Gray<br>Gray | Denmark |
| 250V  | 8120-1860 | 6 | Straight*CEE22-VI<br>(Systems Cabinet use) | | | |

*Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.
E = Earth Ground; L = Line; N = Neutral

**Operating Environment**

| | |
|---|---|
| Temperature | 0°C to +55°C |
| Humidity | 5 to 95% (maximum wet bulb temperature = 40°C) |
| Altitude | <4570 meters (15,000 feet) |
| Airflow | 5.8 mm (0.23 in.) minimum clearance underneath the instrument and sufficient clearance at the instrument's right side for air flow that is not obstructed. |

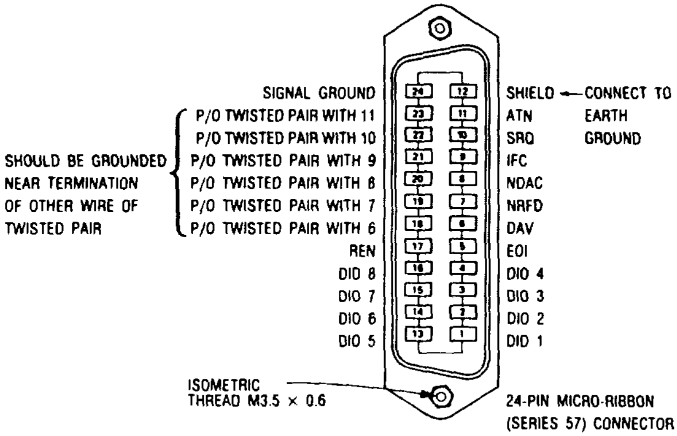
## 1-5. OPERATION UNDER USUAL CONDITIONS.

Operating procedures are broken down into individual functions and are provided starting in paragraph 1-8. Operating messages that may be encountered during operation and maintenance are listed in paragraph 1-7.

## 1-6. TURN-ON PROCEDURES.

1. Apply power to the Signal Generator. Signal Generator will perform a self test for approximately 30 seconds. Verify that the fan on the rear panel is operating.
2. After 30 seconds, verify that the display has no operating message indications. If MSSG Annunciator is on or display is flashing, press MSSG push button and see paragraph 1-7 for explanation. Verify the following condition exists on the Signal Generator front panel:

| | |
|---|---|
| RF Frequency | 100MHz |
| Start Frequency | OFF(100MHz) |
| Stop Frequency | OFF(100.lMHz) |
| Frequency Reference | OFF(100MHz) |
| Amplitude | ON(-140dBm) |
| Start Amplitude | OFF(-140dBm) |
| Stop Amplitude | OFF(-135dBm) |
| Amplitude Reference | OFF(1.0µV) |
| EMF Mode | OFF |
| AM Depth | OFF(50% Internal) |
| FM Deviation | OFF(50KHz Internal) |
| Phase Deviation | OFF(1.0 radians Internal) |
| Pulse Modulation | OFF(External DC Source) |
| Modulation Frequency | 1.0KHz |
| Modulation Output Level | OFF (1V) |
| Frequency Sweep Mode | AUTO |
| Amplitude Sweep Mode | AUTO |
| Sweep Time | 500msec |
| All other controls and indicators | OFF |




**Logic Levels**

The Hewlett-Packard Interface Bus logic levels are TTL compatible, i.e., the true (1) state is 0.0 Vdc to +0.4 Vdc and the false (0) state is 2.5 Vdc to +5 Vdc.

**Programming and Output Data Format**

Refer to Section III, "Operation".

**Mating Connector**

HP 1251-0293; Amphenol 57-30240.

**Mating Cables Available**

HP 10631A, 1 metre (3.3 ft.), HP 10631B, 2 metres (6.6 ft.)
HP 10631C, 4 metres (13.2 ft.), HP 10631D, 0.5 metres (1.6 ft.)

**Cabling Restrictions**

1. A Hewlett-Packard Interface Bus system may contain no more than 2 metres (6.6 ft.) of connecting cable per instrument.
2. The maximum accumulative length of connecting cable for any Hewlett-Packard Interface Bus system is 20 metres (65.6 ft.).

Figure 1-4. Hewlett-Packard Interface Bus Connections.

## 1-7. OPERATING MESSAGES.

Some operator actions and Signal Generator failures cause operating messages. If a message appears in the display, or MSSG Annunciator lights, or the display flashes, press MSSG push button to display message.

Operating Messages are grouped into seven categories as follows:

| | |
|---|---|
| ***Parameters Changed Messages*** | Local: These messages are automatically displayed except for C32 and C33.<br>HP-IB: All of these messages can be output via HP-IB using “OC”.<br>Parameters Changed messages (message code is prefixed with "C") inform you that the Signal Generator has changed some other setting to allow a new setting. Some of the Signal Generator's functions cannot occur simultaneously with other functions, so the Parameters Changed message indicates the Signal Generator has automatically adjusted or turned off the functions that are preventing the new setting. These messages occur immediately after executing a command that causes some other parameter to automatically change.<br>HP-IB: You can read only the first Parameters Changed message if more than one has occurred. For example, assume that more than one Parameters Changed message has occurred since either the Status Byte was cleared or since the last time "OC" was executed. Then a Parameters Changed message using "OC" will enable you to read out only the first message. |
| ***Execution Error Messages*** | Local: These messages are automatically displayed.<br>HP-IB: All of these messages are output via HP-IB using "OE".<br>Execution Error messages (message code is prefixed with "E") describe the Signal Generator's reason for not executing an attempted setting. Some settings are not possible because functions are coupled together due to limitations of internal circuit configuration. This coupling will sometimes limit the execution of a setting because one function limits the setting of the other. When your setting attempt cannot occur, the Signal Generator explains the restriction. Execution Error messages occur immediately after executing a command that does not execute.<br>HP-IB: You can read only the first Execution Error message if more than one has occurred. For example, assume that more than one Execution Error message has occurred since either the Status Byte was cleared or since the last time "OE" was executed. Then reading an Execution Error message using "OE" will enable you to read out only the first message. |

***Hardware Error Messages***

Local: These messages are all queued up and can be displayed using the MSSG push button.

HP-IB: All of these messages are output via HP-IB using "OH".

Hardware Error messages (message number is prefixed with "H") signal the presence of either an internal circuit hardware problem or a firmware problem that you might be able to resolve. Hardware Error messages may occur independently of function execution. A maximum of 20 Hardware Error messages can be queued up to be accessed either by the MSSG push button on the front panel, or via HP-IB using "OH". If you are unable to repair the hardware error, refer to Section III for more information.

***Information Messages***

Local: These messages are automatically displayed when you execute a function.

HP-IB: Most of these messages can be output via HP-IB using the Output Display capability after you execute a function. 11, 12, 159, and 160 cannot be read via HP-IB. To understand a way to read 141 through 149 and 151 through 159, refer to that message description on the following page.

Information messages (message code is prefixed with "I") provide useful information about instrument settings or conditions.

***Prompt Messages***

Local: These messages are automatically displayed when you execute a function.

HP-IB: Most of these messages can be output via HP-IB using the Output Display capability after you execute a function. P91 cannot be read via HP-IB.

Prompt messages (message code is prefixed with "P") instruct you towards completion of die task or function selection you begin.

***Out-of-Lock Messages***

Out-of-lock messages might appear as queued up messages during operation. (These messages will be disabled if Special Function 119, Disable Settling, is selected.) If any of these messages occur, the instrument might not be functioning properly and need to be serviced. However, some of the messages might be displayed because you have exceeded the instrument's limits. The out-of-lock messages are listed in the Table 1-2. The solution column provides the number(s) of the solution(s) listed below that might eliminate the out-of-lock condition. IF THE PRESCRIBED SOLUTION DOES NOT ELIMINATE THE MESSAGE, THE INSTRUMENT SHOULD BE SERVICED.

Also, these messages can be output using "OH".

***Writing Messages***

The messages listed (message code is prefixed with "V")might occur when you are accessing the special functions.

When using the instrument locally you will usually be able to view each message whenever it occurs.

When using the instrument via HP-IB, you can access some messages using the "OE" or "OH" commands. Messages accessed this way can be output in the form of a message code number or an actual alphanumeric message string. In the following message listing, the message code number that can be output over HP-IB is provided to the far right of the message. If no message code number is provided, then that message can only be read over HP-IB using Output Display (unless otherwise stated), which is also described in Data Output. The messages that can be output using "OE" or "OH" can also be made to issue a service request.

Messages are displayed in a format that shows the wording of the message followed by an alphanumeric code. (Alphanumeric codes combine a letter and a number; for example, C31.) The message listing lists the messages as they are displayed, with the alphanumeric code to the right of the message wording (not to be confused with the message code number in the right margin of the listing). The messages are listed in alphanumeric order.

***When Using the Instrument Locally***. You will usually be able to view each message whenever the Signal Generator is ready to give you information. That is, you don't need to do anything to the instrument to see a message. However, when you execute some instrument functions, a message is queued up and can be displayed using the MSSG push button (these messages are noted in the listing). The MSSG annunciator in the right portion of the display notifies you that a message is queued up. To read queued up messages, just select the MSSG push button repeatedly. When you read "END OF MESSAGE LIST .00" you know there are no more messages in that list.

***When Controlling the Instrument via HP-IB***. You can access most of the messages using the "OC", "OE", and "OH" commands. Messages accessed this way can be output in the form of a message code number or as an actual alphanumeric message string. In the message listing in this instruction, the message code number that can be output over HP-IB is provided to the far right of the message. If no message code number is provided in the listing, then that message can be read over HP-IB using Output Display (unless otherwise stated). If any unique message retrieval procedures exist for a message, they will be described in the individual message description. Also, any message that cannot be read via HP-IB will be noted.

Many of the messages that can be output over HP-IB can be made to initiate a service request.

**NO MESSAGES .00 0**

No messages are queued up to be displayed or output over HP-IB.

HP-IB: This message may be output with "OH" (or "MG" in combination with Output Display).

**NO MESSAGE .00 0**

No message is available for output over HP-IB. This message is never displayed locally.

HP-IB: This message may be output with "OC" or "OE".

**END OF MESSAGE LIST .00 0**

The end of the copied list has been reached. This message is viewed after displaying the entire copied message list (by repeatedly selecting the MSSG push button).

HP-IB: This message may be output with "OH" (or "MG" in combination with Output Display).

**FR.SWP+PULSE TURNED OFF .C1 2001**

RF frequency sweep with pulse modulation was turned off. Either START AMPTD or STOP AMPTD was selected (HP-IB: AA or AB) when RF frequency sweep was on with pulse modulation.

**AMPTD REF SET TO 1.OOUV .C2 2002**

Amplitude reference was set to 1.00 µV. The amplitude reference was set to the dBµV reference (which is 1.00 µV) due to the selection of dBµV (HP-IB: DU). Subsequent amplitude displays will be in dBµV.

**ADJUSTED .002UV RESOLN'N .C3 2003**

Amplitude setting was adjusted to 0.002 µV resolution. In EMF mode, if an attempt is made to set an increment or amplitude reference with an odd number of nanovolts (for example, 0.501, 0.503, 0.505 µV, etc.), that value will be adjusted up to an even number of nanovolts.

**INCR+AMPTD REF CHANGED .C4 2004**

The increment setting and amplitude reference were changed. Changing between EMF and non-EMF amplitude modes could cause the increment and amplitude settings to be reset to allowable values.

**AM TURNED OFF C11 2011**

AM was turned off. Either START AMPTD, STOP AMPTD, or PULSE (SHIFT AM) was selected (HP-IB codes: AA, AB, or PL) when AM was on. AM is not possible with pulse modulation or amplitude sweep.

**FM TURNED OFF .C12 2012**

FM was turned off. OM was selected when FM was on. FM cannot be done simultaneously with OM.

**PHASE MOD TURNED OFF .C13 2013**

OM was turned off. FM was selected when OM was on. OM cannot be done simultaneously with FM.

**PULSE MOD TURNED OFF .C14 2014**

Pulse modulation was turned off. Either START AMPTD, STOP AMPTD, or AM was selected (HP-IB codes: AA, AB, or AM) when pulse modulation was on. Pulse modulation is not possible when amplitude sweep or AM are on.

**SWEEP TIME ADJUSTED .C21 2021**

Sweep time was adjusted to the minimum allowed setting. The sweep time setting was less than the minimum allowed for the type of sweep selected. Either a Stepped Frequency Sweep was set with the sweep time set less than 275 ms, or amplitude sweep was set with the sweep time set less than 20 ms.

**FREQ SWEEP TURNED OFF .C22 2022**

RF frequency sweep was turned off. Either FREQ, START AMPTD, or STOP AMPTD was selected (HP-IB codes: FR, AA, AB) when RF frequency sweep was on.

| | | |
|---|---|---|
| **FR.SWP+AM TURNED OFF** | **.C23** | **2023** |

RF frequency sweep and AM were turned off. Either START AMPTD or STOP AMPTD was selected (HP-IB codes: AA, AB) when RF frequency sweep was on with AM.

| | | |
|---|---|---|
| **AMPTD SWP TURNED OFF** | **.C31** | **2031** |

Amplitude sweep was turned off. One of the following functions was selected when amplitude sweep was on: START FREQ, STOP FREQ, AMPTD, AM, or PULSE (SHIFT AM). (HP-IB codes: FA, FB, AP, AM, PL).

| | | |
|---|---|---|
| **AA.OFF...30DB MAX SPAN** | **.C32** | **2032** |

Start amplitude setting was turned off because the new stop amplitude setting was set more than 30 dB away from the start amplitude setting. This message is queued up until it is read, amplitude sweep is turned off, or the start amplitude is set again.

| | | |
|---|---|---|
| **AB.OFF...30DB MAX SPAN** | **.C33** | **2033** |

Stop amplitude setting was turned off because the new start amplitude setting was set more than 30 dB away from the stop amplitude setting. This message is queued up until it is read, amplitude sweep is turned off, or the stop amplitude is set again.

| | | |
|---|---|---|
| **INCR ADJUSTED** | **.C41** | **2041** |
| **AMPTD REF ADJUSTED** | **.C42** | **2042** |

Increment setting adjusted.

Amplitude reference setting adjusted.

Changing between EMF and non-EMF amplitude modes could cause the increment and/or amplitude settings to be reset to allowable values.

| | | |
|---|---|---|
| **NEXT STEP NOT POSSIBLE** | **.E1** | **4001** |

Next step is not possible. The current setting cannot be stepped up or down (as attempted) with the increment set value. To clear the message without changing instrument settings, select the SHIFT push button twice. If you want to read a message that might more specifically describe the setting problem, attempt a data setting similar to the step attempt that caused this error message.

| | | |
|---|---|---|
| **NOT POSSIBLE. ABOVE MAX** | **.E2** | **4002** |

Not possible above the maximum setting ever allowed. The attempted setting is above the function's maximum possible setting (independent of other functions.)

| | | |
|---|---|---|
| **NOT POSSIBLE. BELOW MIN** | **.E3** | **4003** |

Not possible below the minimum setting ever allowed. The attempted setting is below the function's minimum possible setting (independent of other functions.)

| | | |
|---|---|---|
| **SELECT MOD.PREFIX FIRST** | **.E4** | **4004** |

Select the type of modulation first. A modulation source was selected when a modulation setting was not displayed. Before selecting the modulation source, select any of the following modulation types: AM, FM, $\phi$M (SHIFT FM), or PULSE (SHIFT AM).

HP-IB: Specify the modulation type code (AM, FM, PM, or PL) before the modulation source prefix code (NT, XA, XD, BA, or BD).

**SELECT SWP.PREFIX FIRST** **.E5** **4005**

Select the type of sweep first. A sweep mode (auto, manual, or single) was selected without specifying the sweep type (frequency or amplitude sweep). Select START FREQ, STOP FREQ, START AMPTD, or STOP AMPTD before selecting the sweep mode. HP-IB: Specify the sweep type code (FA, FB, AA, or AB) before the sweep mode code (SA, SM, or SG).

**PLEASE SELECT FUNCTION** **.E6** **4006**

Please select an active function. A data value was attempted during manual sweep or when no active function existed. Select a valid function before attempting to enter a data value. HP-IB: Precede the data entry with a function prefix code.

**SP6 PREVENTS INT+EXT.FM** **.E7** **4007**

Special Function 6 (FM Pre-Emphasis On) prevents the selection of a summed internal and external FM source. Select Special Function 206 (FM Pre-Emphasis Off) to select INT+(EXT AC), INT+(EXT DC), or Special Function 112 (Internal + External Low Rate FM). HP-IB: Select SP206 before selecting FM source codes FMBA, FMBD, or SP112.

**TURN.OFF.SWP FIRST...SP123** **.E8** **4008**

Turn off the frequency sweep before attempting those settings because Special Function 123 (Phase Continuous Frequency Sweep) is the type of frequency sweep currently selected. Turn off either START FREQ or STOP FREQ and then try your setting again.

HP-IB: Turn off the frequency sweep with FAOF or FBOF, then retry settings.

**SP9+AM LIMIT MAX AMPTD** **.E9** **4009**

Special Function 9 (Attenuator Range Hold) selected with the current AM setting limits amplitude levels attainable. Turn off Attenuator Range Hold (with Special Function 209) and/or reduce AM to a depth that will allow the amplitude setting, or refer to sequence dependency in paragraph 1-15.

**FUNCTION OFF.NO STEP** **E10** **4010**

The active function is off so its value cannot be stepped. Turn on or set the active function to a valid setting before using the Step push buttons.

**FUNC DISALLOWS OFF/ON** **.E11** **4011**

The active function cannot be turned off or on. You attempted to turn off or turn on either FREQ, MOD FREQ, or sweep TIME (SHIFT START FREQ) (HP-IB codes FR, MF, or ST).

**ONLY OFF/ON IS ACTIVE** **.E12** **4012**

Only the OFF ON push button can be selected. Select an active function other than PULSE (SHIFT AM), EMF (SHIFT INCR SET), or KNOB HOLD (SHIFT <-) before entering data.

HP-IB: Don't send data immediately after selecting PL, EM, or KH.

**NO ACTIVE FUNCTION** **.E13** **4013**

Currently no function is active. Select an active function and then try your setting again.

**NOTHING TO BACKSPACE** **.E14** **4014**

There is no data in the display to backspace. Select an active function before using BACK SP.

**NO CURSOR TO MOVE** **.E15** **4015**

Currently no function is active so no cursor can be moved. Select an active function to activate the Knob before attempting to move cursors.

**INVALID SHIFT FUNC** **.E16** **4016**

The push button you have selected cannot be preceded by the SHIFT push button. Select a valid shift function.

HP-IB: Select the proper function code without SH. SH should only be used with the Display Output capability or to get back the normal display of instrument settings (HP-IB code: SHSH). Refer to Output Display information in paragraph 1-15.

**INVALID TERMINATOR** **.E17** **4017**

This message is never displayed locally.

HP-IB: Invalid terminator received. Send correct terminator code for function you are trying to set.

**BAD PREFIX RECEIVED** **.E18** **4018**

A bad prefix has been detected by the Signal Generator. Terminator push buttons do not have shift functions.

HP-IB: The Signal Generator received a set of characters that cannot be recognized. Send a valid HP-IB code or use the HP-IB Device Clear command and try again.

**MAXIMUM OF 10 DIGITS** **.E19** **4019**

This message is never displayed locally.

HP-IB: The Signal Generator ignored some digits in the entry. Only send 10 digits (including significant leading zeros).

**NUMBER OUT OF RANGE** **.E20** **4020**

The attempted setting exceeds a numeric value which can be represented internally as a number. Select a value within the Signal Generator's settable range.

**AMPTD LIMITS MAX AM** **.E24** **4024**

The amplitude setting limits the maximum AM setting. Reduce either the amplitude setting or the attempted AM setting and try again.

**AM LIMITS MAX AMPTD** **.E25** **4025**

The AM setting limits the maximum amplitude setting. Reduce either the AM setting or the attempted amplitude setting and try again.

**ONLY INT/EXT.DC PULSE** **.E26** **4026**

Only an internal or external dc source is possible with pulse modulation. With pulse modulation, select only INT or EXT DC. For other modulation sources, select the modulation type of AM, FM, or $\phi$M (SHIFT EM) before selecting the modulation source.

HP-IB: Send only PLNT or PLXD, or ensure codes AM, FM, or PM are sent before XA, BA, or BD.

**PULSE MOD ONLY .E27 4027**

Pulse modulation can only be off or on. Since pulse modulation can only be turned off or on, knob rotation, cursor positioning push buttons, and Step push buttons cannot affect the pulse modulation function.

HP-IB: Select a function code before UP, DN, KL, or KR.

**AM PREVENTS PULSE MOD .E28 4028**

AM is not possible with pulse modulation. Turn off AM (HP-IB: AMOF) before selecting pulse modulation.

**PULSE MOD PREVENTS AM .E29 4029**

Pulse modulation is not possible with AM. Turn off pulse modulation (HP-IB: PLOF) before selecting AM.

**TURN OFF EMF FOR DBM .E30 4030**

When in the EMF mode, dBm units are not possible. Turn off EMF before selecting dBm amplitude units.

**NO RELATIVE AMPTD SWP .E31 4031**

Relative values for amplitude sweep cannot be set directly. Convert the desired relative setting value to absolute units, then set the amplitude sweep in absolute units. Select only FREQ or AMPTD (HP-IB code FR or AP) before attempting relative settings.

**NO RELATIVE FREQ SWP .E32 4032**

Relative values for frequency sweep are not possible. Select only FREQ or AMPTD (HP-IB: FR or AP) before attempting relative settings.

**ONLY FREQ/AMPTD REL .E33 4033'**

No relative units are possible with the requested setting. Select only FREQ or AMPTD (HP-IB: FR or AP) before attempting relative settings.

**AP.REF DISALLOWS DBmV .E34 4034**

An amplitude reference cannot be set in dBμV. Set amplitude to the desired value in dBμV, then select REL ZERO (HP-IB: APRZ).

**AP.SWP DISALLOWS DBmV .E35 4035**

An amplitude sweep cannot be directly set in dBμV. Convert the desired dBμV setting value to absolute units, then set the amplitude sweep in absolute units.

**FM COUPLED FUNC LIMIT .E38 4038**

FM is coupled with an attempted setting. You are either attempting a setting that is impossible or attempting to set functions in an incorrect order. This message could also have been caused by executing Special Function 0 or 100 when one special function was coupled to other instrument settings.

**INT+EXT.FM PREVENT SP6 .E39 4039**

Special Function 6 (FM Pre-Emphasis) cannot be selected when an internal source is summed with an external source. Select a single FM source (INT, EXT AC, EXT DC, or Special Function 5; HP-IB: FMNT, FMXA, FMXD, or SP5) before selecting FM Pre-Emphasis, or refer to sequence dependency in paragraph 1-15.

**PM LIMITS MIN FREQ .E40 4040**

The OM setting limits the minimum RF frequency value that can be selected. Either reduce OM deviation, or select an RF frequency that allows the OM deviation, or refer to sequence dependency in paragraph 1-15.

**PM LIMITS MAX FREQ .E41 4041**

The OM setting limits the maximum RF frequency value that can be selected. Either reduce OM deviation, or select an RF frequency that allows the OM deviation, or refer to sequence dependency in paragraph 1-15.

**FREQ LIMITS MAX PM .E42 4042**

The RF frequency setting limits the maximum value of OM deviation that can be selected. Set the RF frequency to a value in a band that allows the desired value of OM deviation, or select a OM deviation that is allowed to the current RF frequency, or refer to sequence dependency in paragraph 1-15.

**FR.SWP+AUTO LIMITATION .E45 4045**

Stepped Frequency Sweep cannot sweep in the Auto sweep mode under the following conditions:

Setting start and stop end-points if one end-point is less than 4.130860 MHz with a second end-point greater than 132.187500 MHz.

Setting a Stepped Frequency Sweep across 1057.500000 MHz.

If neither of these restrictions apply to the attempted setting, refer to sequence dependency in paragraph 1-15.

**TURN OFF SWEEP FIRST .E46 4046**

Turn off frequency sweep first. To access Special Function 123 (Phase Continuous Frequency - Sweep), turn off the start and the stop frequency that was set for the Stepped Frequency Sweep. If this solution does not apply to your attempted setting, refer to sequence dependency in paragraph 1-15.

**FREQ SWP + SP8 LIMIT .E47 4047**

Stepped Frequency Sweep cannot sweep in the auto sweep mode across 132.187500 MHz. Select manual or single sweep, or refer to sequence dependency in paragraph 1-15.

**FR.SWP+SP223 LIMIT.TIME .E48 4048**

Special Function 223 (Stepped Frequency Sweep) limits the minimum sweep time that can be selected. Either turn off frequency sweep (HP-IB: FAOF FBOF) before setting the sweep time, or refer to sequence dependency in paragraph 1-15.

**FREQ.SWP+SWP.TIME LIMIT** **.E49** **4049**

The start or stop frequency setting is limited by the currently selected combination of:

Phase Continuous Frequency Sweep (Special Function 123), and the current sweep time setting, and possibly the current start and stop frequency settings, and possibly FM.

To resolve this error, either

1. Turn off frequency sweep (HP-IB: FAOF FBOF) and then possibly select Stepped Frequency Sweep (Special Function 223), or
2. Select a valid sweep time setting, or
3. Possibly turn off FM, or
4. Refer to sequence dependency in paragraph 1-15.

**SP123 LIMITS MIN TIME** **.E50** **4050**

The minimum sweep time that can be selected is limited by the currently selected combination of:

Phase Continuous Frequency Sweep (Special Function 123), and the current start and stop frequency settings, and possibly FM.

To resolve this error, either:

1. Turn off frequency sweep (HP-IB: FAOF or FBOF) and then possibly select Stepped Frequency Sweep (Special Function 223), or
2. Select a valid sweep time setting, or
3. Possibly turn off FM, or
4. Refer to sequence dependency in paragraph 1-15.

**SP123 LIMITS MAX TIME** **.E51** **4051**

The maximum sweep time that can be selected is limited by the currently selected combination of:

Phase Continuous Frequency Sweep (Special Function 123), and the current start and stop frequency settings, and possibly FM.

To resolve this error, either:

1. Turn off frequency sweep (HP-IB: FAOF FBOF) and then possibly select Stepped Frequency Sweep (Special Function 223), or
2. Select a valid sweep time setting, or
3. Possibly turn off FM, or
4. Refer to sequence dependency in paragraph 1-15.

**AP.SWP PREVENTS FR.SWP** **.E52** **4052**

Amplitude sweep and frequency sweep cannot be done simultaneously. Turn off amplitude sweep (HP-IB: AAOF ABOF) before attempting frequency sweep.

**FM PREVENTS AUTO SWP** **.E53** **4053**

FM during Stepped Frequency Sweep is only possible in manual and single sweep modes. Possibly refer to sequence dependency in paragraph 1-15.

**AUTO SWP PREVENTS FM** **.E54** **4054**

FM during Stepped Frequency Sweep is only possible in manual and single sweep modes. Possibly refer to sequence dependency in paragraph 1-15.

**FR.SWP+FM...LIMIT** **.E55** **4055**

FM is coupled with frequency sweep and one of those settings is limiting the setting of the other. This message could also have been caused by executing Special Function 0 or 100 when one special function was coupled to other instrument settings. Either set FM deviation to a value that is allowed by start and stop frequencies, or set start and stop frequencies to values that allow the FM setting, or refer to sequence dependency in paragraph 1-15.

**DCFM+SP117+216 LIMIT** **.E56** **4056**

DC-coupled FM, Special Function 117 (DCFM Update Mode), and Special Function 216 (DCFM Correction On) are coupled with Special Function 123 (Phase Continuous Frequency Sweep), and one of those settings is limiting the selection of a frequency sweep. To resolve this error, either:

1. Turn off FM, or
2. Select a non-dc-coupled FM source, or
3. Turn off Special Function 117, or
4. Turn on Special Function 116 (DC FM Correction Off), or
5. Select a combination of those special functions, or
6. Refer to sequence dependency in paragraph 1-15.

**PM PREVENTS AUTO SWP** **.E57** **4057**

∅M during Stepped Frequency Sweep is only possible in manual and single sweep modes. Possibly refer to Figure 1-5.

**AUTO SWP PREVENTS PM** **.E58** **4058**

∅M during Stepped Frequency Sweep is only possible in manual and single sweep modes. Possibly refer to Figure 1-5.

**FREQ SWEEP + PM LIMIT** **.E59** **4059**

∅M is coupled with frequency sweep and one of those settings is limiting the setting of the other. Either set ∅M deviation to a value that is allowed by start and stop frequencies, or set start and stop frequencies to values that allow the ∅M setting, or refer to sequence dependency in paragraph 1-15.

**AMPTD SPAN 30DB MAX** **.E63** **4063**

An amplitude span of 30 dB is the maximum possible span. Either select an amplitude sweep setting within the 30 dB span limitation or turn off the other amplitude sweep start or stop value (HP-IB: AAOF or ABOF).

**AP.SWP LIMITS MIN TIME** **.E64** **4064**

The minimum sweep time possible for amplitude sweep is 20 ms. Either select another sweep time or turn off amplitude sweep (HP-IB: AAOF ABOF).

**AP.SWP PREVENTS SP9** **.E65** **4065**

Special Function 9 (Attenuator Range Hold) is not possible during amplitude sweep. Turn off amplitude sweep (HP-IB: AAOF ABOF) and set amplitude (HP-IB: AP) before selecting attenuator range hold (HP-IB: SP9).

**SP9 PREVENTS AP.SWP .E66 4066**

Amplitude sweep is not possible when Special Function 9 (Attenuator Range Hold) is selected. Select Attenuator Range Hold Off (Special Function 209) before selecting amplitude sweep.

**AM PREVENTS AP.SWP .E68 4068**

Amplitude sweep is not possible when AM is selected. Turn off AM (HP-IB: AMOF) before selecting amplitude sweep.

**AP.SWP PREVENTS AMPTD .E69 4069**

Output amplitude cannot be set during amplitude sweep. Turn off amplitude sweep (HP-IB: AAOF ABOF) before selecting the output amplitude.

**AMPTD SWP PREVENTS AM .E70 4070**

AM is not possible during an amplitude sweep. Turn off amplitude sweep (HP-IB: AAOF ABOF) before selecting AM.

**AP.SWP PREVENTS AP.OFF .E71 4071**

Output amplitude cannot be turned off during amplitude sweep. Turn off the amplitude sweep (HP-IB: AAOF ABOF) before turning off the output amplitude.

**AP.SWP PREVENTS PULSE .E72 4072**

Pulse modulation is not possible during an amplitude sweep. Turn off the amplitude sweep (HP-IB: AAOF ABOF) before selecting pulse modulation.

**AP.SWP PREVENTS SP4 .E73 4073**

Special Function 4 (ALC OFF) is not possible during amplitude sweep. Turn off amplitude sweep (HP-IB: AAOF ABOF) before selecting ALC OFF (HP-IB: SP4).

**SP4 PREVENTS AP.SWP .E74 4074**

Amplitude sweep is not possible when Special Function 4 (ALC OFF) is selected. Select Disable ALC OFF (Special Function 204) before selecting amplitude sweep.

**SP9 LIMITS MIN AMPTD .E75 4075**

Special Function 9 (Attenuator Range Hold) limits the minimum amplitude that can be selected. To resolve this problem, either

1. Select Attenuator Range Hold Off (Special Function 209), or
2. Select an amplitude within the held amplitude range selected, or
3. Refer to sequence dependency in paragraph 1-15.

**SP9 LIMITS MAX AMPTD .E76 4076**

Special Function 9 (Attenuator Range Hold) limits the maximum amplitude that can be selected. To resolve this problem, either

1. Select Attenuator Range Hold Off (Special Function 209), or
2. Select an amplitude within the held amplitude range selected, or
3. Refer to sequence dependency in paragraph 1-15.

**AMPTD+SP9 LIMIT MAX.AM .E77 4077**

The amplitude selected with Special Function 9 (Attenuator Range Hold) limits the maximum value of AM that can be selected. To resolve this problem, either

1. Select Attenuator Range Hold Off (Special Function 209), or
2. Reduce the amplitude setting to get the desired AM setting, or
3. Select an AM setting allowed with the held range and amplitude setting selected, or
4. Refer to sequence dependency in paragraph 1-15.

**SP9 PREVENTS PULSE .E78 4078**

Pulse modulation is not possible when Special Function 9 (Attenuator Range Hold) is selected. Select Attenuator Range Hold Off (Special Function 209) before selecting pulse modulation.

**PULSE PREVENTS SP9 .E79 4079**

Special Function 9 (Attenuator Range Hold) is not possible when pulse modulation is selected. Turn off pulse modulation (HP-IB: PLOF) and set output amplitude (HP-IB: AP) to the desired level before selecting attenuator range hold (HP-IB:SP9).

**SP9 PREVENTS SP4 .E80 4080**

Special Function 4 (ALC Off) is not possible when Special Function 9 (Attenuator Range Hold) is selected. Select Attenuator Range Hold Off (Special Function 209) before selecting ALC off.
HP-IB: Send SP209 before SP4.

**SP4 PREVENTS SP9 .E81 4081**

Special Function 9 (Attenuator Range Hold) is not possible when Special Function 4 (ALC Off) is selected. Disable ALC Off (Special Function 204) before selecting attenuator range hold.
HP-IB: Send SP204 before SP9.

**AM PREVENTS SP4 .E82 4082**

Special Function 4 (ALC Off) is not possible when AM is selected. Turn off AM before selecting ALC off.
HP-IB: Send AMOF before SP4.

**PULSE PREVENTS SP4 .E83 4083**

Special Function 4 (ALC Off) is not possible when pulse modulation is selected. Turn off pulse modulation before selecting ALC off.
HP-IB: Send PLOF before SP4.

**SP4 PREVENTS AM .E84 4084**

AM is not possible when Special Function 4 (ALC Off) is selected. Select Disable ALC Off (Special Function 204) before setting AM.
HP-IB: Send SP204 before AM.

**SP4 PREVENTS PULSE .E85 4085**

Pulse modulation is not possible when Special Function 4 (ALC Off) is selected. Select Disable ALC Off (Special Function 204) before selecting pulse modulation.
HP-IB: Send SP204 before PL.

**INVALID SPCL FUNCTION .E86 4086**

An invalid special function number was selected. Select a special function number that exists.

**SOME SPCLS STAYED ON .E87 4087**

Some special functions remained selected after you selected Special Function 0 or 100 because certain special functions were coupled to other instrument settings. (This message will only occur if more than one special function remains on. Special Function 0 or 100 not turning off just one special function will display a message describing the reason that one special function was not turned off.) View the special functions to see which are still on by selecting SPCL (SHIFT -) (HP-IB: Use SP and read the display; refer to the Output Display information discussion in HP-IB Remote Operation. The special functions might remain selected because of a sequence dependency problem. Possibly refer to sequence dependency in paragraph 1-15.

**0.9 HZ LIMIT REACHED .E88 4088**

A maximum RF frequency change of 0.9 Hz can be accumulated using Special Function 240 (Decrement Frequency 0.1 Hz) or Special Function 241 (Increment Frequency 0.1 Hz). To get another 0. 1 Hz step, directly set the RF frequency to 1 Hz resolution.

**SAVE/RECALL MAX = 50 E.92 4092**

The maximum recall register number is 50. Select register numbers only between 00 and 50.

**RECALL NOT DEFINED .E93 4093**

No instrument settings are saved in this register. The register could have been cleared with Special Function 251 (Clear Recall Registers) or because of a hardware error. This error E93 occurs simultaneously with hardware error H10.

**SEQ NOT SET...4 DIGITS .E94 4094**

Sequence was not set, 4 digits are required. Try the sequence setting again using two digits fork both the start and stop sequence register numbers.

**ADRS VALID 0-30 ONLY .E95 4095**

HP-IB addresses are valid only between 0 and 30. Select an HP-IB address between 00 and 30, or select 31 for Listen Only capability.

**MASK VALID ONLY 0-255 .E96 4096**

The RQS mask is valid only between decimal 0 and 255. Set the RQS mask between those values.

**HIT AMPTD=CLEAR RVS.PWR .HI 7001**

Press the AMPTD push button to reset the reverse-power-protect circuitry. A reverse-power condition has been sensed. After this condition is eliminated, select the AMPTD push button to reset the protection circuitry.

HP-IB: Send AP after the condition is eliminated. Message H2 will always occur after the reverse-power-protect circuitry is reset in response to message H1.

**RVS.PWR PROTECT CLEARED .H2 7002**

The reverse-power protect circuitry was previously tripped but is now reset.

**RECALL ERROR FOUND .H10 7010**

A recall error has been found. This message could be due to a hardware failure (for example, loss of RAM memory). The message means that a recall register that was recalled had no instrument settings saved in it. The register could have been cleared with Special Function 251 (Clear Recall Registers) or because of a hardware error. This error H10 occurs in conjunction with execution error E93.

**MSSG BUFFER OVERFLOWED .H11 7011**

The message buffer has overflowed. Some messages were lost.

**INSTRUMENT PRESET .I1**

Instrument Preset is being executed. This message cannot be read via HP-IB using Output Display because it automatically clears from the display after execution completes.

**PARTIAL PRESET .12**

Partial Preset is being executed. This message cannot be read via HP-IB using Output Display because it automatically clears from the display after execution completes.

**YYMMDD = FIRMWARE CODE .I3**

This message is an example of the Signal Generator's display of the current firmware version which is accessed with Special Function 249. In this example, YYMMDD represents the numbers that will appear in the display where YY is the last two digits of the year, MM is the number of the month, and DD is the day of the month. For example, 570218 would be February 18, 1957.

**KNOB INCR TURNED OFF .I11**

Knob increment mode was turned off. Cursor positioning push buttons (HP-IB: KL or KR) turn off the Knob Increment mode.

**SETTINGS DISPLAY OFF .I21**

Special Function 135 (Disable Display) was selected and the display of the instrument settings is disabled.

Special Function 235 (Re-enable Display) re-enables the display of instrument settings.

**PHASE STEP DOWN 1 DEG .I22**

**PHASE STEP UP 1 DEG .I23**

The RF signal's output phase was stepped down by 1 degree.

The RF signal's output phase was stepped up by 1 degree.

These messages are activated with Special Function 250.

**SPCL FUNC VERIFY OFF .I24**

Special Function 111 (Special Function Verify Off) was selected and the automatic Special Function verification is disabled. A special function description will not be displayed automatically whenever a special function is selected. The display of special function descriptions can be re-enabled with Special Function 211.

**ENTERING SERVICE MODE .I25**

Entering the Service Mode. Special Function 3 was just selected. Either refer to Section I, Remote Operation information about writing messages to the display. Select any function to exit this mode.

**SYS CONTROL DISABLED** **.I31**

HP-IB system control capabilities were just disabled. The HP-IB address was just set which disables the Signal Generator's system control capabilities accessed with Special Function 3.

**ADRS=LISTEN ONLY** **.I32**

The instrument is configured as a listen-only device over HP-IB.

**LISTEN ONLY DISABLED** **.I33**

The instrument is no longer configured as a listen-only device. The instrument's HP-IB address setting was changed from 31 to a value between 00 and 30.

**WAIT FOR FM LOOP LOCK** **.I40**

Wait for the Signal Generator's internal FM circuitry to complete its setting. This message cannot be read via HP-IB using Output Display because it automatically clears from the display after execution completes. This message is displayed when switching from a dc-coupled FM source to a non-dc-coupled FM source. No additional external settling time allowance is necessary to settle within 100 Hz of the selected frequency.

**RF.FREQ=DISPLAY -0.9 HZ** **.I49**
**RF.FREQ=DISPLAY -0.8 HZ** **.I48**
**RF.FREQ=DISPLAY -0.7 HZ** **.I47**
**RF.FREQ=DISPLAY -0.6 HZ** **.I46**
**RF.FREQ=DISPLAY -0.5 HZ** **.I45**
**RF.FREQ=DISPLAY -0.4 HZ** **.I44**
**RF.FREQ=DISPLAY -0.3 HZ** **.I43**
**RF.FREQ=DISPLAY -0.2 HZ** **.I42**
**RF.FREQ=DISPLAY -0.1 HZ** **.I41**
**RF.FREQ=DISPLAY +0.1 HZ** **.I51**
**RF.FREQ=DISPLAY +0.2 HZ** **.I52**
**RF.FREQ=DISPLAY +0.3 HZ** **.I53**
**RF.FREQ=DISPLAY +0.4 HZ** **.I54**
**RF.FREQ=DISPLAY +0.5 HZ** **.I55**
**RF.FREQ=DISPLAY +0.6 HZ** **.I56**
**RF.FREQ=DISPLAY +0.7 HZ** **.I57**
**RF.FREQ=DISPLAY +0.8 HZ** **.I58**
**RF.FREQ=DISPLAY +0.9 HZ** **.I59**

The current RF output frequency is now summed with one of these 0.1 Hz steps listed in messages 141 through 149 and 151 through I59 that were accessed with either Special Function 240 (Decrement Frequency by 0.1 Hz) or Special Function 241 (Increment Frequency by 0.1 Hz). The RF frequency addition is automatically deleted with any specific frequency setting or change. These messages are queued up and can be displayed using MSSG.

HP-IB: Execute "MG" and read the display. Perform this entire process repeatedly to see the RF frequency addition message. Note that reading these messages over the bus (using MG) could cause transient hardware and service messages to be deleted from the message list.

**CRUNCH CRUNCH MMMMMMM** **.I60**

Amplitude sweep is possible and is currently being set. This message cannot be read via HP-IB using Output Display because it automatically clears from the display after execution completes.

**SPCLS OFF.ENTER NUMBER .P0**

All special functions are off. To select a special function, select its number.

**HIT MSSG FOR EACH MSSG .P1**

More than one message is in the message list, select MSSG (HP-IB CODE: MG) to see each message.

HP-IB: Note that when retrieving a message list using the "OH" command when more than one message exists, this is the first message you will receive in the list. Refer to the Output Messages discussion in paragraph 1-15.

**OFF/ON SELECTS EMF ON .P2**

The EMF mode is off. Select OFF ON (HP-IB: EMON) to select EMF on.

**OFF/ON SELECTS EMF OFF .P3**

The EMF mode is on. Select OFF ON (HP-IB: EMOF) to select EMF off.

**HIT OFF/ON = HOLD FUNC .P4**

Knob Hold is off, to hold the active function on the Knob, select OFF ON.

HP-IB: Send the HP-IB code of the desired active function followed by KHON.

**HIT OFF/ON = HOLD OFF .P5**

Knob Hold is on, to turn off the Knob Hold function, select OFF ON (HP-IB: KHOF).

**USE KNOB/UP/DN/NUMBER .P11**

The Help function allows you to view the descriptions and code numbers of special functions. Select either the Knob, Step push buttons, or a function's number.

**RELEASE ALL KEYS .P91**

Release all push buttons. At turn on, it appears that a push button is being held down. Release all push buttons to continue. If a push button is not being held down, your instrument may need servicing (refer to the Service Manual). This message cannot be read via HP-IB using Output Display because it automatically clears from the display after the push button is released. Also, HP-IB operation is halted when a push button is held down with this message displayed.

**SPCL 3 ENTRY ERROR .V12**

This message occurs if the characters entered were not valid.

**ENTER SERVICE CMD .V16**

This message occurs if the ASCII code entered was not recognized as valid.

**MESSAGE 1 CLEARED .V90**

This message occurs when 6 5 5 is selected.

**MESSAGE 2 CLEARED .V91**

This message occurs when 6 6 5 is selected.

**MESSAGE 1 IS FULL .V92 21092**

This message might occur after attempting to enter codes into an already full message. This message sets the Execution Error bit in the 8642 Status Byte.

**MESSAGE 2 IS FULL .V93 21093**

This message might occur after attempting to enter codes into an already full message. This message sets the Execution Error bit in the 8642 Status Byte.

**MESSAGE 1 UNDEFINED .V94 21094**

This message might occur when manipulating message 1. The message means that message 1 has not been initialized or RAM memory was lost. To initialize the message, select 6 5 5. This message sets the Hardware Error bit in the 8642 Status Byte.

**MESSAGE 2 UNDEFINED .V95 21095**

This message might occur when manipulating message 2. The message means that message 2 has not been initialized or RAM memory was lost. To initialize the message, select 6 6 5. This message sets the Hardware Error bit in the 8642 Status Byte.

**Table 1-2. Out of Lock Messages**

| Message | | | Message Code Number | Solution | Comments |
|---|---|---|---|---|---|
| A19 | OUT OF LOCK ERROR | .D0 | 3000 | 1, 2 | Doubler ALC loop is out of lock. |
| A19 | TRANSIENT FAILURE | .D1 | 3001 | 1, 2 | Doubler ALC loop had been out of lock but now appears to be in lock. |
| A6A2 | OUT OF LOCK ERROR | .F0 | 5000 | 3 | Internal hardware cannot phase lock to the external reference. |
| A6A2 | TRANSIENT FAILURE | .F1 | 5001 | 3 | Internal hardware had not been able to phase lock to the external reference but now appears to be in lock. |
| A6A1 | OUT OF LOCK ERROR | .F2 | 5002 | 2, 3 | FM phase lock loop cannot track and lock to the time base. |
| A6A1 | TRANSIENT FAILURE | .F3 | 5003 | 2, 3 | FM phase lock loop had not been able to track and lock to the time base but now appears to be able to track and lock to the time base. |
| A13 | OUT OF LOCK ERROR | .00 | 14000 | 1, 2 | Output Section ALC loop is out of lock. |
| A13 | TRANSIENT FAILURE | .01 | 14001 | 1, 2 | Output Section ALC loop had been out of lock but now appears to be in lock. |
| A11 | OUT OF LOCK ERROR | .R0 | 17000 | 2, 3 | Reference phase lock loop is out of lock. |
| A11 | TRANSIENT FAILURE | .R1 | 17001 | 2, 3 | Reference phase lock loop had been out of lock but now appears to be in lock. |
| A12 | OUT OF LOCK ERROR | .S0 | 18000 | 2, 3 | Sum loop is out of lock. |
| A12 | TRANSIENT FAILURE | .S1 | 18001 | 2, 3 | Sum loop had been out of lock but now appears to be in lock. |
| A9 | OUT OF LOCK ERROR | .T0 | 19000 | 3 | IF phase lock loop is out of lock. |
| A9 | TRANSIENT FAILURE | .T1 | 19001 | 3 | IF phase lock loop had been out of lock but now appears to be in lock. |
| A14 | OUT OF LOCK ERROR | .X0 | 23000 | 3 | Heterodyne module SAW loop is out of lock. |
| A14 | TRANSIENT FAILURE | .X1 | 23001 | 3 | Heterodyne module SAW loop had been out of lock but now appears to be in lock. |
| A7 | OUT OF LOCK ERROR | .Z0 | 25000 | 3 | SAW loop is out of lock |
| A7 | TRANSIENT FAILURE | .Z1 | 25001 | 3 | SAW loop had been out of lock but now appears to be in lock. |

**Out of Lock Solutions**

1. Either reduce the amplitude level, reduce the AM depth, or reduce the external modulation input level.
2. Either reduce the FM or ∅M deviation, reduce the modulation frequency, change the external modulation rate, or change the external modulation level.
3. Either the external reference is not operating properly or connections are faulty at the rear panel connector, EXT REF INPUT. (The internal hardware may still be faulty even though the message is gone; that is, the message would appear again if you connected another - external reference to the instrument.)

## 1-8. OPERATING PROCEDURES.

Operation is broken down into the following functions:

**SETTING INSTRUMENT FUNCTIONS (paragraph 1-9)**

- RF Frequency
- Amplitude
- OFF ON
- Modulation
- Modulation Oscillator Output
- Simultaneous Modulation Source

**MODIFYING SETTINGS (paragraph 1-10)**

- Tune Knob
- Step, Increment Set
- Knob Increment
- Knob Hold
- Entry Off
- Display Editing

**MAKING RELATIVE SETTINGS (paragraph 1-11)**

- Amplitude Relative
- Frequency Relative

**SELECTING SPECIAL FUNCTIONS (paragraph 1-12)**

- Help Function
- Special Functions
- Detailed description of all Special Functions

**SELECTING A SWEEP (paragraph 1-13)**

- Stepped Frequency Sweep
- Phase Continuous Frequency Sweep
- Amplitude Sweep
- Sweep Time Calculations

**RECALLING INSTRUMENT SETTINGS (paragraph 1-14)**

- Save
- Recall
- Sequence, Set Sequence

**HP-IB REMOTE OPERATION (paragraph 1-15)**

- HP-IB Address
- HP-IB Capabilities
- Data Input
- Data Output
- Output Messages
- Clear
- Remote, Local
- Local Lockout, Set Local
- Status Byte
- System Controller
- Additional HP-IB Information

**WRITING MESSAGES TO DISPLAY** (paragraph 1-16)

## 1-9. SETTING INSTRUMENT FUNCTIONS

***RF FREQUENCY***

1. On Signal Generator, press SHIFT then INSTR PRESET push buttons.
2. Press FREQ push button.
   Enter the desired RF frequency from 100KHz to 2GHz using the numeric push buttons.
   Select GHz, MHz, KHz, or Hz.
3. Verify entered frequency is displayed along with cursor and FREQ annunciator.

***AMPLITUDE***

1. Press AMPTD push button.
   Enter the desired level from -140 to +15dBm using the numeric push buttons.
   Select dBm, V, mV, µV, or dBµV.
2. Verify entered amplitude is displayed along with cursor and AMPTD annunciator.
3. If EMF amplitude is required, proceed as follows:
   Press SHIFT, INCR SET, then OFF ON push buttons to activate the EMF mode.

   **NOTE**

   **Any previous amplitude setting will be automatically changed to reflect its equivalent EMF voltage setting.**

   Enter the desired level from -140 to +15dBm using the numeric push buttons.
   Select V, mV, µV, or dBµV.
   Verify entered EMF amplitude is displayed along with cursor and EMF annunciator.
   To Exit EMF mode, press SHIFT, INCR SET, then OFF ON push buttons.
4. To turn off RF output amplitude and harmonics without adjusting the output attenuators, press RF OFF ON push button.
5. To turn on the amplitude to its previously selected value, press RF OFF ON push button.

**OFF ON**

1. If function is on, press function push button (AM,FM etc) then OFF ON push button to deactivate function without changing last stored value.
2. If function is off, press function push button (AM,FM etc) then OFF ON push button to activate function using last stored value.

**MODULATION**

1. Set AM as follows:
   - Press SHIFT, then INSTR PRESET push button.
   - If internal modulation oscillator is used,
     Press AM then INT push button.
     Press MOD FREQ push button and enter desired modulation frequency from 20Hz to 100KHz.
     Press AM push button and enter desired depth from 0 to 99.9%.
     Verify entered data is displayed along with cursor, AM, and INT annunciator.
   - If external modulation signal is used,
     Connect 1 Vpeak ±5% sinewave external input to AM connector.

**CAUTION**

**Do not apply more than 15V peak to the AM input connector.**

Select EXT AC or EXT DC push button as required.
Adjust external input frequency from DC to 100KHz for desired modulation rate.
Press AM push button and enter desired depth from 0 to 99.9%.

**NOTE**

**When using external source, modulation depth setting sets the input sensitivity per volt and not actual depth. Any voltage change on the AM input connector will change AM depth.**

Verify entered data is displayed along with cursor, AM, EXT, and AC/DC annunciator.

**NOTE**

**AM can be used simultaneously with FM or (ÆM) Phase Modulation. Combinations of internal and external modulation are possible using INT + function.**

- To deactivate AM mode, press AM then OFF ON push buttons.

**MODULATION-Continued**

2. Set FM as follows:
   - Press SHIFT, then INSTR PRESET push button.
   - If internal modulation oscillator is used,
     Press FM then INT push button.
     Press MOD FREQ push button and enter desired modulation frequency from 20Hz to 100KHz.
     Press FM push button and enter desired deviation from 300KHz to 1.5MHz.
     Verify entered data is displayed along with cursor, FM, and INT annunciator.
   - If external modulation signal is used,
     Connect 1 Vpeak ±5% sinewave external input to FM/∅M connector.

**CAUTION**

**Do not apply more than 15V peak to the FM/ÆM input connector.**

Select EXT AC or EXT DC push button as required.
Adjust external input frequency from DC to 100KHz for desired modulation rate.
Press FM push button and enter desired deviation from 300KHz to 1.5MHz.

**NOTE**

**When using external source, modulation deviation setting sets the input sensitivity per volt and not actual deviation. Any voltage change on the FM/ÆM input connector will change FM deviation.**

Verify entered data is displayed along with cursor, FM, EXT, and AC/DC annunciator.

**NOTE**

**FM can be used simultaneously with AM or Pulse Modulation. Combinations of internal and external modulation are possible using INT + function.**

- To deactivate FM mode, press FM then OFF ON push buttons.

**MODULATION-Continued**

3. Set ∅M (Phase modulation) as follows:
   - Press SHIFT, then INSTR PRESET push button.
   - If internal modulation oscillator is used,
     Press SHIFT, FM, then INT push buttons.
     Press MOD FREQ push button and enter desired modulation frequency from 20Hz to 15KHz.
     Press SHIFT then FM push buttons and enter desired deviation from 0 to 200 radians.
     Verify entered data is displayed along with cursor, ∅M, and INT annunciator.
   - If external modulation signal is used,
     Connect 1 Vpeak ±5% sinewave external input to FM/∅M connector.

**CAUTION**

**Do not apply more than 15V peak to the FM/ÆM input connector.**

Select EXT AC or EXT DC push button as required.
Adjust external input frequency from DC to 1 5KHz for desired modulation rate.
Press SHIFT then FM push buttons and enter desired deviation from 0 to 200 radians.

**NOTE**

**When using external source, modulation deviation setting sets the input sensitivity per volt and not actual deviation. Any voltage change on the FM/ÆM input connector will change ÆM deviation.**

Verify entered data is displayed along with cursor, ∅M, EXT, and AC/DC annunciator.

**NOTE**

**ÆM can be used simultaneously with AM or Pulse Modulation. Combinations of internal and external modulation are possible using INT + function.**

- To deactivate ∅M mode, press SHIFT, FM then OFF ON push buttons.

**MODULATION-Continued**

4. Set Pulse modulation as follows:
   - Press SHIFT, then INSTR PRESET push button.
   - If internal modulation oscillator is used,
     Press SHIFT, AM, then INT push button.
     Press MOD FREQ push button and enter desired modulation frequency from 10Hz to 50KHz.
     Press SHIFT, AM, then OFF ON push buttons.
     Verify entered data is displayed along with cursor, PULSE and INT annunciator.
   - If external modulation signal is used,
     Press SHIFT, AM, then EXT DC push buttons.
     Connect ±20 volt external input to Pulse connector (trigger voltage is ±1.5V).

**CAUTION**

**Do not apply more than 20 volts to the Pulse input connector.**

Adjust external input frequency from DC to 50KHz for desired modulation rate.
Press SHIFT, AM, then OFF ON push buttons.
Verify entered data is displayed along with cursor, PULSE, EXT, and DC annunciators.

**NOTE**

**Pulse modulation can be used simultaneously with FM or ÆM (Phase Modulation).**

- To deactivate Pulse Modulation mode, press SHIFT, AM, then OFF ON push buttons.

**MODULATION OSCILLATOR OUTPUT**

1. Press SHIFT, then INSTR PRESET push button.
2. Press MOD FREQ push button and enter desired output frequency from 20Hz to 100KHz.
3. Verify MOD.FR and entered value is displayed.
4. Press SHIFT then MOD FREQ push buttons and enter desired output level from 0 to 3Vpeak.
5. Verify entered data is displayed along with cursor and MOD OUT. Signal is available for use at MOD connector.

**SIMULTANEOUS MODULATION SOURCE**

1. Select Internal + External AC as follows:
   - Set desired modulation mode (AM/FM/∅M) using internal oscillator as specified in setting MODULATION procedure.
   - Connect an external AC-coupled signal to the connector of the modulation mode selected in step 1. Set signal level to 1 Vpeak ±5%. Set signal frequency to desired rate.
   - Press SHIFT then EXT AC push buttons.
   - Verify entered data is displayed along with INT, EXT, and AC annunciators.
2. Select Internal + External DC as follows:
   - Set desired modulation mode (AM/FM/∅M) using internal oscillator as specified in setting MODULATION procedure.
   - Connect an external DC-coupled signal to the connector of the modulation mode selected in previous step. Set signal level to 1 Vpeak ±5%. Set signal frequency to desired rate.
   - Press SHIFT then EXT DC push buttons.
   - Verify entered data is displayed along with INT, EXT, and DC annunciators.

## 1-10. MODIFYING SETTINGS

***TUNE KNOB***

1. On Signal Generator, press SHIFT then INSTR PRESET push buttons.
2. Press → or ← to position cursor in the display over digit to be changed.
3. Turn the Tune KNOB to change digit to desired value.

***STEP, INCREMENT SET***

1. Press desired function push button (FREQ, AMPTD, etc) then INCR SET push button and enter desired value.
2. Press STEP (UP/DOWN) push buttons to modify the displayed value with the cursor by the amount stored in step 1.

***KNOB INCREMENT***

1. On Signal Generator, press SHIFT then INSTR PRESET push buttons.
2. Press desired function push button (FREQ, AMPTD, etc) then INCR SET push button and enter desired value.
3. Press SHIFT then → push buttons.
4. Turn the Tune KNOB to modify the displayed value with the cursor by the amount stored in step 2.

**NOTE**

**When changing active functions, Knob Increment will continue to remain selected, which means that with any functions, the Knob will change the function's setting by the increment set value.**

3. Press SHIFT then RF OFF ON push buttons to turn off Tune KNOB.

***KNOB HOLD***

1. Press desired function push button (FREQ, AMPTD, etc) then SHIFT, ←, then OFF ON push buttons.
2. Select any other desired function.

**NOTE**

**Two cursors over the function value indicate Tune KNOB hold (step 1). Single cursor indicates active function (step 2).**

3. Use Step, Data, and, the OFF ON push buttons to change the active function, and the Tune Knob to change the HOLD function.
4. Press SHIFT then <- push buttons to turn off Tune KNOB hold.

***ENTRY OFF***

1. Press SHIFT then RF OFF/ON to disable Knob Hold, Knob Increment, Tune Knob, Step, and Data push buttons until an active function is selected.

**NOTE**

**All cursors will disappear from the display showing there is no active function.**

### *DISPLAY EDITING*

1. Press BACK SP push button to erase least significant digit.
2. Press SHIFT then SHIFT to resume normal operational display.

## 1-11. MAKING RELATIVE SETTINGS

### *AMPLITUDE RELATIVE*

1. On Signal Generator, press SHIFT then INSTR PRESET push buttons.
2. If amplitude reference value is to be transferred from present amplitude output:
   - Verify displayed amplitude value is the desired reference value.
   - Press SHIFT then AMPTD push buttons.

   **NOTE**

   **Amplitude that was present in display is now stored reference value. Displayed amplitude will be zero. All subsequent amplitude entries will now be offset from the reference setting stored.**

   - Verify AMPTD and REL annunciators are on.
3. If amplitude reference value is to be entered:
   - Press SHIFT then FREQ push buttons and enter the desired reference setting.

   **NOTE**

   **Displayed amplitude and all subsequent amplitude entries will now be offset from the reference setting entered in previous step.**

   - Verify AMPTD and REL annunciators are on.

4. To deactivate Relative Mode, press SHIFT then OFF ON push buttons.

***FREQUENCY RELATIVE***

1. On Signal Generator, press SHIFT then INSTR PRESET push buttons.
2. If frequency reference value is to be transferred from present frequency output:
   - Verify displayed frequency value is the desired reference value.
   - Press SHIFT then AMPTD push buttons.

**NOTE**

**Frequency that was present in display is now stored reference value. Displayed frequency will be zero. All subsequent frequency entries will now be offset from the reference setting stored.**

   - Verify FREQ and REL annunciators are on.

3. If frequency reference value is to be entered:
   - Press SHIFT then FREQ push buttons and enter the desired reference setting.

**NOTE**

**Displayed frequency and all subsequent frequency entries will now be offset from the reference setting entered in previous step.**

   - Verify FREQ and REL annunciators are on.

4. To deactivate Relative Mode, press SHIFT then OFF ON push buttons.

## 1-12. SELECTING SPECIAL FUNCTIONS.

***HELP FUNCTION***

1. On Signal Generator, press SHIFT then STEP (UP) push buttons.
2. Select the desired mode of accessing special function descriptions 0 through 251,
   - Use Tune KNOB to scroll past special functions.
   - Use STEP (UP) push button to increment to the next special functions number and description.
   - Enter the number of the desired special function to be viewed.

**NOTE**

**Help function only allows the operator to view numbers and descriptions of special functions and does not activate the special function mode..**

3. Press SHIFT then STEP (DOWN) push buttons to deactivate Help mode.

## SPECIAL FUNCTIONS

1. Press SHIFT then - push buttons and enter the number of the desired special function (activate or deactivate).
2. Press SHIFT then - push buttons to view the current special function modes active.

**NOTE**

**Use Help function, Table 1-3, or see listing for information on special functions available.**

### *DETAILED DESCRIPTIONS OF ALL SPECIAL FUNCTIONS*

| NO. | DESCRIPTION |
|---|---|
| ***0*** | ***Special Functions 4 through 9 Off***. This special function turns off Special Functions 4 through 9. (Sometimes all these special functions will not be turned off if the instrument state is dependent on a special function. A message will be displayed to notify you if a special function remained on after you selected Special Function 0.) Special functions can also be turned off individually. |
| ***3*** | ***Service Mode***. This special function causes the Signal Generator to enter its service mode. Refer to para 1-16 for information about writing messages to the display, or refer to Section III for information about servicing the instrument. Select any function to exit this mode if this push button was accidentally selected. |
| ***4*** | ***ALC Off***. This special function opens the output leveling loop to provide (typically) a 5dB improvement in third order intermodulation at a 2kHz offset. Typical output level accuracy is +2dB when ALC Off is selected. |
| ***5*** | ***External Low Rate FM ON.*** See number 112. |
| ***6*** | ***FM Pre-emphasis On***. Special Function 6 can be selected to pre-emphasize internal or external FM modulating signals with a 7501ts time constant. (Pre-emphasis boosts high frequencies in the modulating signal prior to modulating the carrier.). |
| ***7*** | ***Low Distortion FM/ÆM On***. This special function switches shaper circuitry into the FM/OM loop, reducing total harmonic distortion. |
| ***9*** | ***Attenuator Range Hold On***. When Attenuator Range Hold is selected, the Signal Generator's output attenuators are fixed and the output ALC loop controls signal amplitude. This produces a 30dB range with monotonic, step-to-step amplitude increments. |
| ***100*** | ***All Special Function Codes Less than 200 Off***. This special function turns off special functions 4 through 9, 111 through 119, 121 through 123, 134, and 135. (Sometimes all these special functions will not be turned off if the instrument state is dependent on a special function. A message will be displayed to notify you if a special function remained on after you selected Special Function 100.) Special functions can also be turned off individually. |

**Table 1-3. Summary of Special Functions; Function to Code**

| Function | Special Function Description | Select | Code off |
|---|---|---|---|
| RF Frequency | | | |
| | Decrement Frequency by 0.1 Hz | 240 | |
| | Increment Frequency by 0.1 Hz | 241 | |
| | Phase Adjust by Knob or Step Keys | 250 | |
| | Phase Decrement 1° | 242 | |
| | Phase Increment 1° | 243 | |
| | Phase Decrement 5° | 244 | |
| | Phase Increment 5° | 245 | |
| Amplitude | ALC Off | 4 | 204 |
| | Attenuator Range Hold | 9 | 209 |
| | Disable Settling | 119 | 219 |
| FM | External Low Rate FM | 5 | 205 |
| | Internal + External Low Rate FM | 112 | 212 |
| | FM Pre-Emphasis | 6 | 206 |
| | Low Distortion FM/(M | 7 | 207 |
| | Negative FM Polarity | 115 | 215 |
| | DC FM Correction Off | 116 | 216 |
| | DC FM Update Mode | 117 | 217 |
| | AC-Coupled DC FM | 118 | 218 |
| | Prefer Heterodyne Band | 8 | 208 |
| | Disable Settling | 119 | 219 |
| ΦM | Low Distortion FM/ΦM | 7 | 207 |
| | Negative ΦM Polarity | 114 | 214 |
| | Disable Settling | 119 | 219 |
| Modulation Oscillator | Modulation Frequency Correction Off | 113 | 213 |
| | Calibrate Modulation Frequency Bands Again | 248 | |
| Sweep | Sweep Up and Down | 121 | 221 |
| | Linear Amplitude Sweep | 122 | 222 |
| | Phase Continuous Frequency Sweep | 123 | 223 |
| | Disable Settling | 119 | 219 |
| Miscellaneous | Special Functions 4-9 Off | | 0 |
| | All Special Functions < 200 Off | | 100 |
| | Special Function Verification Off | 111 | 211 |
| | Display Firmware Information | 249 | |
| | Disable Display | 135 | 235 |
| | Turn Off LCD Lighting | 134 | 234 |
| | Clear Recall Registers | 251 | |
| Service | Service Mode | 3 | |

***DETAILED DESCRIPTIONS OF ALL SPECIAL FUNCTIONS-Continued***

| NO. | DESCRIPTION |
|---|---|
| **111** | ***Disable the Automatic Special Function Verification Display***. This special function disables the automatic display of the special function description that normally occurs after each special function is selected. |
| **112** | ***Internal + External Low Rate FM On***. This special function and number 5 typically provide 0.4 Hz to 200 kHz external ac-coupled FM with the Signal Generator remaining in a phase locked state. Input coupling required for these functions makes the Signal Generator especially sensitive to dc voltage fluctuations. Therefore, relatively small dc voltage changes can cause the Signal Generator to lose phase lock, requiring one to two seconds to regain the locked condition. Special functions 112 or 5 is turned off when another FM modulation source is selected. |
| **113** | ***Modulation Frequency Correction Off***. This special function disables the singleband calibration of the modulation frequency oscillator that normally occurs whenever the modulation oscillator frequency is set or the internal modulation oscillator is put into use. When this calibration is disabled, the typical modulation frequency switching time is decreased by approximately 200 ms. |
| **114** | ***Negative ÆM Polarity***. This special function causes a positive voltage applied to the external FM/OM INPUT to cause a phase lag and a negative voltage applied to cause a phase lead. |
| **115** | ***Negative FM Polarity***. This special function causes a positive voltage applied to the external FM/OM INPUT to cause a negative frequency shift and a negative voltage applied to cause a positive frequency shift. |
| **116** | ***DC FM Correction Off***. This special function prevents the initial frequency correction that occurs when de-coupled FM is selected. Normally, when de-coupled FM is selected, the FM phase lock loop is open, causing an offset in the selected RF output frequency. To correct this initial offset, the de-coupled signal is momentarily switched off, while an internal counter is used to determine the amount of RF frequency offset. The frequency offset is then corrected, and the de-coupled signal is switched back on (DC FM Correction). Disabling this correction causes a decrease in switching time by approximately 200ms. |
| **117** | ***DC FM Update Mode On***. With the FM loop unlocked, RF output frequency changes with a change in applied dc signal and with the normal drift of an unlocked VCO that occurs over time and temperature. In the DC FM Update Mode, the Signal Generator measures and displays these RF frequency changes. |

***DETAILED DESCRIPTIONS OF ALL SPECIAL FUNCTIONS-Continued***

| NO. | DESCRIPTION |
|---|---|
| **118** | ***AC-Coupled DC FM On*** . When the Signal Generator is in the normal ac-coupled FM mode, the external signal is applied to the FM loop through circuitry that uses a phase lock loop to ensure the accuracy of the output signal. In dc-coupled FM (DC FM), the phase lock loop is unlocked and the external signal is applied directly to the unlocked VCO. With Special Function 118 selected, the input signal is ac-coupled to the unlocked FM VCO blocking any applied dc component. (Typical low-frequency corner frequency is 1 Hz.) Using DC FM avoids the phase shifts associated with ac-coupled FM circuitry and allows maximum stereo separation. An external dc-coupled FM source must be in use with Special Function 118 to get these benefits. |
| **119** | ***Disable Settling***. This special function allows the Signal Generator's microprocessor to respond to new commands without waiting for the internal circuitry to settle, improving response time by up to 40 ms. When using this special function, it's possible to select a function before the previous function has finished settling. Also Special Function 119 disables out-of-lock messages. |
| **121** | ***Sweep Up and Down On***. Sweep Up and Down is a type of sweep that causes the Signal Generator to sweep from the start end-point to the stop end-point and then from the stop end-point to the start end-point in the same amount of time (during auto or single sweep modes). |
| **122** | ***Linear Amplitude Sweep***. This special function selects a linearly stepped output rather than the usual logarithmically stepped output. Use a sweep time greater than 900ms to obtain maximum sweep resolution. |
| **123** | ***Phase Continuous Frequency Sweep***. Phase Continuous Frequency Sweep enables the Signal Generator to frequency sweep between two end-points in a linear, phase continuous manner. |
| **134** | ***Turn Off LCD Lighting***. This special function turns off the LCD back-lighting in the display. |
| **135** | ***Disable Display***. Special Function 135 causes the Signal Generator to execute commands without displaying the instrument state (useful in secure environments). |
| **204** | ***Disable ALC Off***. This special function re-enables the output leveling loop that was disabled with Special Function 4. |
| **205** | ***External Low Rate FM Off***. This special function turns off the FM modulation source selected with Special Function 5. When Special Function 5 is turned off in this way, the Signal Generator selects external, ac-coupled FM. |
| **206** | ***FM Pre-Emphasis Off***. This special function turns off the pre-emphasis selected with Special Function 6. |
| **207** | ***Low Distortion FM/ÆM Off***. This special function switches out the shaper circuitry inserted with Special Function 7. |

***DETAILED DESCRIPTIONS OF ALL SPECIAL FUNCTIONS-Continued***

| NO. | DESCRIPTION |
|---|---|
| **209** | ***Attenuator Range Hold Off*.** This special function turns off Attenuator Range Hold selected with Special Function 9. |
| **211** | ***Special Function Verify On*.** This special function re-enables the automatic display of the special function description disabled with Special Function 111. |
| **212** | ***Internal + External Low Rate FM Off*.** This special function turns off the FM modulation source selected with Special Function 112. When Special Function 112 is turned off this way, the Signal Generator selects internal and external, ac-coupled FM summed together. |
| **213** | ***Modulation Frequency Correction On*.** This special function re-enables the single-band calibration that normally occurs whenever the modulation oscillator frequency is set or the internal modulation oscillator is put into use. |
| **214** | ***Positive OM Polarity*.** This special function disables Special Function 114 and re-enables the normally selected phase relationships. A positive voltage applied to the external FM/OM INPUT causes a phase lead and a negative voltage applied causes a phase lag. |
| **215** | ***Positive FM Polarity*.** This special function disables Special Function 115 and re-enables the normally selected frequency-shift relationships. A positive voltage applied to the external FM/OM INPUT causes a positive frequency shift and a negative voltage applied causes a negative frequency shift. |
| **216** | ***DC FM Correction On***. This special function re-enables the correction disabled by Special Function 116. |
| **217** | ***DC FM Update Mode Off***. This special function disables the DC FM update that occurs with Special Function 117. |
| **218** | ***AC-Coupled DC FM Off.*** This special function re-selects the dc coupling to the FM circuitry disabled with Special Function 118. |
| **219** | ***Re-enable Settling*.** This special function re-enables the settling disabled with Special Function 119. |
| **221** | ***Sweep Up and Down Off*.** This special function re-enables the normal sweep disabled with Special Function 121. Special Function 221 sets the Signal Generator to repeatedly sweep from the start end-point to the stop end-point (during auto or single sweep modes). |
| **222** | ***Logarithmic Amplitude Sweep*.** This special function selects the normally selected logarithmic stepped output disabled with Special Function 122. |
| **223** | ***Phase Continuous Frequency Sweep Off*.** This special function turns off the Phase Continuous Frequency Sweep selected with Special Function 123. |
| **234** | ***Turn On LCD Lighting*.** This special function turns on the LCD lighting disabled with Special Function 134. |

***DETAILED DESCRIPTIONS OF ALL SPECIAL FUNCTIONS-Continued***

| NO. | DESCRIPTION |
|---|---|
| **235** | ***Re-enable Display***. This special function re-enables the display of settings disabled with Special Function 135. |
| **240** | ***Decrement Frequency by 0.1Hz***. |
| **241** | ***Increment Frequency by 0.1Hz.*** These special functions change the RF signal's output frequency in 0.1 Hz steps each time the special function is selected. Changing frequency in these ways cause a message to be queued up in the message list that provides the total increment or decrement. |
| **242.** | ***Phase Decrement 1 Degree.*** |
| **243.** | ***Phase Increment 1 Degree*.** |
| **244.** | ***Phase Decrement 5 Degrees*.** |
| **245.** | ***Phase Increment 5 Degrees*.** These functions change the RF signal's output phase by the indicated amount each time the special function is selected. |
| **248** | ***Calibrate the Modulation Frequency Bands Again.*** This special function enables you to initiate the calibration sequence that normally only occurs during instrument power up. This function can be used, for example, to recalibrate the modulation oscillator frequency bands if normal modulation frequency correction has been disabled with Special Function 113. Calibration typically takes one to two seconds. |
| **249** | ***Display Firmware Information.*** This special function displays the current firmware version with a message such as "YYMMDD = FIRMWARE CODE .13". In this example YYMMDD represents the numbers that will appear in the display where YY is the last two digits of the year, MM is the number of the month, and DD is the day of the month. For example, 841225 would be December 25, 1984. |
| **250** | ***Phase Adjustment from Knob and Step Up and Step Down Keys*.** This function enables control over the RF signal's output phase in one degree steps using either the Knob or Step Push buttons. |
| **251** | ***Clear Recall Registers*.** This special function clears all recall registers. |

## 1-13. SELECTING A SWEEP

### *STEPPED FREQUENCY SWEEP*

**NOTE**

**Calculations for step size/number of steps to sweep time are provided under SWEEP TIME CALCULATIONS below.**

1. On Signal Generator, press SHIFT then INSTR PRESET push buttons.
2. Press START FREQ push button and enter desired start frequency.
3. Press STOP FREQ push button and enter desired stop frequency.
4. Press SHIFT then START FREQ push buttons and enter desired sweep time.
5. Select desired sweep mode;
   - For AUTO sweep, press SHIFT then START AMPTD push button. Verify data entry is correct and START, FREQ, SWPNG and STOP Annunciators are on.
   - For Manual sweep, press SHIFT then STOP FREQ push button. Turn Tune KNOB for sweep.
   - For Single sweep, press SHIFT then STOP AMPTD push button.
6. To deactivate sweep mode, Press START FREQ, OFF ON, STOP FREQ, and then OFF ON push buttons.

### *PHASE CONTINUOUS FREQUENCY SWEEP*

**NOTE**

**Calculations for minimum sweep span, maximum sweep span, sweep time, and X-axis steps are provided under SWEEP TIME CALCULATIONS listed below.**

1. On Signal Generator, verify not in stepped frequency sweep mode.
2. Press SHIFT then - push buttons and enter 1 2 3.
3. Press START FREQ push button and enter desired start frequency.
4. Press STOP FREQ push button and enter desired stop frequency.
5. Press SHIFT then START FREQ push buttons and enter desired sweep time.

***PHASE CONTINUOUS FREQUENCY SWEEP-Continued***

6. Select desired sweep mode;
   - For AUTO sweep, press SHIFT then START AMPTD push button. Verify data entry is correct and START, FREQ, SPCL, SWPNG and STOP Annunciators are on.
   - For Manual sweep, press SHIFT then STOP FREQ push button. Turn Tune KNOB for sweep.
   - For Single sweep, press SHIFT then STOP AMPTD push button.
7. To deactivate sweep mode, Press START FREQ, OFF ON, STOP FREQ, and then OFF ON push buttons. Press SHIFT then push buttons and enter 2 2 3. Press SHIFT then SHIFT push buttons.

***AMPLITUDE SWEEP***

**NOTE**

**Calculations for step size/number of steps to sweep time are provided under SWEEP TIME CALCULATIONS below.**

1. On Signal Generator, press SHIFT then INSTR PRESET push buttons.
2. Press START AMPTD push button and enter desired start amplitude.
3. Press STOP AMPTD push button and enter desired stop amplitude.
4. Press SHIFT then START FREQ push buttons and enter desired sweep time.
5. Select desired sweep mode;
   - For AUTO sweep, press SHIFT then START AMPTD push button. Verify data entry is correct and FREQ, SWPNG, START, AMPTD, and STOP Annunciators are on.
   - For Manual sweep, press SHIFT then STOP FREQ push button. Turn Tune KNOB for sweep.
   - For Single sweep, press SHIFT then STOP AMPTD push button.
6. To deactivate sweep mode, Press START AMPTD, OFF ON, STOP AMPTD, and then OFF ON push buttons.

## *SWEEP TIME CALCULATIONS*

1. Calculations for Stepped Frequency Sweep:

***Calculate number of steps automatically selected as follows:***

- The number of steps is the minimum of:

$$1023$$

or

$$\left| \text{Start Frequency } (\textit{in Hz}) - \text{Stop Frequency } (\textit{in Hz}) \right|$$

or

$$\left[ \text{INTEGER OF } \left( \frac{\text{Sweep Time } (\textit{in ms})}{\text{Min. Dwell Time } (\textit{in ms})} \right) - 1 \right]$$

***Calculate sweep step size automatically selected as follows:***

- The sweep size is the maximum of:

$$1\ \textit{Hz}$$

or

$$\frac{\left| \text{Start Frequency } (\textit{in Hz}) - \text{Stop Frequency } (\textit{in Hz}) \right|}{1023}$$

or

$$\frac{\left| \text{Start Frequency } (\textit{in Hz}) - \text{Stop Frequency } (\textit{in Hz}) \right|}{\left[ \text{INTEGER OF } \left( \frac{\text{Sweep Time } (\textit{in ms})}{\text{Min. Dwell Time } (\textit{in ms})} \right) - 1 \right]}$$

***Calculate sweep time to select desired number of steps as follows*:**

- Dwell Time =80msec when using special function 119
  =135msec when not using special function 119.
- First, determine the desired number of steps is between the specified limits.
- The *maximum number* of frequency steps equals the minimum of:

$$1023$$

or

$$\frac{\left| \text{Start Frequency (in Hz)} - \text{Stop Frequency (in Hz)} \right|}{1\text{Hz}}$$

***SWEEP TIME CALCULATIONS-Continued***

- The minimum number of frequency steps equals the minimum of:

$$\left[ \text{INTEGER OF} \left( \frac{275\ ms}{\text{Min. Dwell Time } (in\ ms)} - 1 \right) \right]$$

or

$$\frac{\left| \text{Start Frequency On Hz) - Stop Frequency On Hz)} \right|}{1\text{Hz}}$$

- If the desired number of steps is equal to the maximum, use a sweep time setting (in msec) equal to or greater than the result of the following equation:

  (Number of steps +1) X Min. Dwell Time (in msec)

- If the desired number of steps is less than the maximum, use a sweep time setting (in msec) equal to or greater than the result of the above equation but less than the following equation:

  (Number of steps +2) X Min. Dwell Time (in msec)

***Calculate sweep time to select desired step size as follows:***

- First, determine the desired step size is between the specified limits.
- The *maximum step size* equals the maximum of:

1 Hz

or

$$\frac{\left| \text{Start Frequency } (in\ Hz) - \text{Stop Frequency } (in\ Hz) \right|}{\left[ \text{INTEGER OF} \left( \frac{275\ ms}{\text{Min. Dwell Time (in ms)}} - 1 \right] \right.}$$

- The minimum step size is equal to the maximum of:

1Hz

or

$$\frac{\left| \text{Start Frequency On Hz) - Stop Frequency On Hz)} \right|}{1023}$$

- If the desired step size is equal to the minimum, use a sweep time setting (in msec) equal to or greater than the result of the following equation:

$$\left[ \left( \frac{\left| \text{Start Frequency } (in\ Hz) - \text{Stop Frequency } (in\ Hz) \right|}{\text{Step Size } (in\ Hz)} \right) + 1 \right] \text{ X Min. Dwell Time } (in\ ms)$$

***SWEEP TIME CALCULATIONS-Continued***

- If the desired step size is greater than the minimum, use a sweep time setting (in msec) equal to or greater than the result of the above equation but less than the following equation:

$$\left[\left(\frac{|\text{Start Frequency } (\textit{in Hz}) - \text{stop Frequency } (\textit{in Hz})|}{\text{Step Size } (\textit{in Hz})}\right) + 2\right] \times \text{Min. Dwell Time } (\textit{in ms})$$

2. Calculations for Phase Continuous Frequency Sweep:

*Divide Number* = 1 for frequencies up to 132.187500MHz
= 4 for frequencies from 132.1875001 to 264.375000MHz
= 2 for frequencies from 264.375001 to 528.750000MHz
= 1 for frequencies from 528.750001 to 1057.500000MHz
= 0.5 for frequencies from 1057.500001 to 2000MHz

***Calculate the minimum possible (non-zero) frequency sweep span for a desired sweep time setting as follows:***

- Minimum non-zero frequency sweep span (in Hz) equals the maximum of

$$1 \text{ Hz}$$

or

$$\frac{0.2 \textit{ Hz per second}}{\text{Divide Number}} \times \text{Sweep Time } (\textit{in s})$$

- If the result is not an integer, use the next highest integer.

***Calculate the maximum frequency sweep span for a desired sweep time setting as follows:***

- Maximum frequency span (in Hz) equals the minimum of

$$\frac{400\ 000 \text{ Hz}}{\textit{Divide Number}}$$

or

$$\left[\text{INTEGER OF }\left(\frac{500 \textit{ kHz per second}}{\text{Divide Number}} \times \text{Sweep Time } (\textit{in ms})\right)\right]$$

***SWEEP TIME CALCULATIONS-Continued***

***Calculate the minimum (fastest) sweep time setting for a desired (non-zero) frequency span as follows:***

- Minimum sweep time (in msec) equals the maximum of

5 msec

or

| Start Frequency (in Hz) - Stop Frequency (in Hz)| X *Divide Number* X 0.002msec

- If the result is not an integer number of msec, use the next highest integer number of msec.

***Calculate the maximum (slowest) sweep time setting for a desired (non-zero) frequency span as follows:***

- Maximum sweep time (in sec) equals the minimum of

999 sec

or

| Start Frequency (in Hz) - Stop Frequency (in Hz)| X *Divide Number* X 5sec

***Calculate the required sweep time to select a desired number of X-axis steps (1023 maximum) as follows:***

Desired Number of Steps X 1msec

3. Calculations for Amplitude Sweep:

***Calculate number of steps automatically selected as follows:***

- The number of steps is the minimum of:

$$\frac{|\text{ Start Amplitude } (\textit{in dBm}) - \text{Stop Amplitude } (\textit{in dBm})}{0.1\ \textit{dB}}$$

or

$$\left[\text{ INTEGER OF } \left( \frac{\text{Sweep Time } (\textit{in ms})}{3\ \textit{ms}} \right) - 1 \right]$$

***Calculate sweep step size automatically selected as follows:***

- The sweep size is the maximum of:

0.1 *dB*

or

$$\frac{|\text{ Start Amplitude } (\textit{in dBm}) - \text{Stop Amplitude } (\textit{in dBm})\ |}{\left[\text{ INTEGER OF } \left( \frac{\text{Sweep Time } (\textit{in ms})}{3\ \textit{ms}} \right) - 1 \right]}$$

***SWEEP TIME CALCULATIONS-Continued***

***Calculate sweep time to select desired number of steps as follows:***

- First, determine the desired number of steps is between the specified limits.
- The *maximum number* of amplitude steps equals the minimum of:

$$\frac{|\text{Start Amplitude (in dBm)} - \text{Stop Amplitude (in dBm)}|}{0.1\ \text{dB}}$$

- The *minimum number* of amplitude steps equals the minimum of:

5

or

$$\frac{|\text{Start Amplitude (in dBm)} - \text{Stop Amplitude (in dBm)}|}{0.1\ \text{dB}}$$

- If the desired number of steps is equal to the maximum, use a sweep time setting (in msec) equal to or greater than the result of the following equation:

(Number of steps +1) X 3msec

- If the desired number of steps is less than the maximum, use a sweep time setting (in msec) equal to or greater than the result of the above equation but less than the following equation:

(Number of steps +2) X 3msec

***Calculate sweep time to select desired step size as follows:***

- First, determine the desired step size is between the specified limits.
- The maximum step size equals the maximum of:

0.1 dB

or

$$\frac{|\text{Start Amplitude } (\textit{in dBm}) - \text{Stop Amplitude } (\textit{in dBm})|}{5}$$

- The *minimum step size* is equal to 0.1 dB.
- If the desired step size is equal to the minimum, use a sweep time setting (in msec) equal to or greater than the result of the following equation:

$$\left[\left(\frac{|\text{Start Amplitude } (\textit{in dBm}) - \text{Stop Amplitude } (\textit{in dBm})|}{\text{Step Size } (\textit{in dB})}\right) + 1\right] \text{ X } 3\ \textit{ms}$$

- If the desired step size is greater than the minimum, use a sweep time setting (in msec) equal to or greater than the result of the above equation but less than the following equation:

$$\left[\left(\frac{|\text{Start Amplitude } (\textit{in dBm}) - \text{Stop Amplitude } (\textit{in dBm})|}{\text{Step Size } (\textit{in dB})}\right) + 2\right] \text{ X } 3\text{ ms}$$

## 1-14. RECALLING INSTRUMENT SETTINGS

**NOTE**

**The DN = 00 message shows the current register number, and (UP = 01) message shows the next register number (UP = 01).**

***SAVE***

1. Press SAVE push button and,
   - Enter desired register from 00 to 50 for specific register.
   - Press STEP (UP) push button to save in next available register.
   - Press STEP (DOWN) push button to save in most recently accessed register.

***RECALL***

1. Press RECALL push button and,
   - Enter desired register from 00 to 50 for specific register.
   - Press STEP (UP) push button to recall instrument state stored in next available register.
   - Press STEP (DOWN) push button to recall most recently accessed register.

***SEQUENCE, SETSEQUENCE***

1. Press SHIFT then SEQ push buttons and enter the starting and ending registers.
2. Press SEQ push button to recall settings of next register.

**NOTE**

**The NEXT message shows the next register to be called in sequence.**

## 1-15. HP-IB REMOTE OPERATION.

The 8642 is fully programmable via the Hewlett-Packard Interface Bus (HP-IB) which can be operated with any Hewlett-Packard computing controller or computer for automatic system applications. For more information about HP-IB, refer to one or all of the following documents:

- IEEE Standard 488-1978,
- ANSI Standard MCI.1,
- "Improving Measurements in Engineering and Manufacturing" (HP part number 59520058) (the Hewlett-Packard catalog of Electronic Systems and Instruments), or
- "Tutorial Description of the Hewlett-Packard Interface Bus" (HP part number 5952-0156).

All front-panel functions are programmable over HP-IB except Knob rotation and switching the Power from Standby to On.

### *HP-IB ADDRESS*

The Signal Generator's address is set to 19 at the factory both in RAM memory and on an internal switch located inside the instrument. You can change the address in RAM from the front panel.

The address stored in RAM remains valid through switching the Power from Standby to On and unplugging of the ac power cord. However, if the internal battery power is lost, RAM memory is lost and the Signal Generator reads the address on the internal switch. The internal switch address hen becomes the address at turn on. At any time the instrument's HP-IB address can be displayed from the front panel.

***Available Addresses***. Any address from 00 to 30 can be assigned to the instrument.

Setting an address of 31 establishes the Signal Generator as a listen-only device. The listen-only mode causes the instrument to allow either HP-IB or local operation. However, any push buttons pressed while the Signal Generator is receiving HP-IB information could suspend the instrument in an unknown state. Also, with this address setting, the HP-IB control lines should be left open-circuited: IFC, ATN, REN, SRQ, and EOI.

1. To Display the current address from the front panel:
   - Press SHIFT then LOCAL push button.
2. To Change the current address from the front panel:
   - Press SHIFT then LOCAL push button and enter the new address from 00 to 31. Press Hz µV push button.

**NOTE**

**Setting the address from the front panel when the instrument is in its service mode will disable any activated HP-IB control capabilities.**

***HP-IB CAPABILITIES***

The 8642 Signal Generator is designed to be compatible with a controller that interfaces in terms of the 12 bus messages summarized in the HP-IB Capability Reference Table. The bus functions are discussed in more detail in the following text. The Signal Generator's complete capability (as defined by IEEE Standard 488 and the identical ANSI Standard MC1.1) is described at the bottom of Table 14.

In remote mode, all front-panel controls are disabled except the Power switch and the Local push button (the Local push button can be disabled by configuring the instrument in Local Lockout). The Signal Generator will respond to each HP-IB message below according to its associated listen or talk address. (Each of these capabilities is described in more detail on the pages that follow.)

***Input Data.*** When addressed to listen (with REN true), the Signal Generator stops talking and can respond to input data.
***Output Data.*** When addressed to talk, the Signal Generator stops listening and can send output data.
***Clear (Selected Device Clear SDC).*** When addressed to listen (with REN true), the Signal Generator stops talking and responds to SDC by clearing any uncompleted entries or messages.
***Clear (Device Clear DCL).*** Regardless of the addressed state of the Signal Generator (whether addressed to listen or to talk), it stops talking and responds to DC', by clearing any uncompleted entries or messages.
**Local.** When addressed to listen (with REN true), the Signal Generator stops talking ant responds to the Local command by returning from remote control to local control.
***Local Lockout.*** Regardless of the addressed state of the Signal Generator (whether addressed to listen or to talk), it responds to the Local Lockout command by disabling the front-panel Local push button.
***Clear Lockout and Set Local.*** Regardless of the addressed state of the Signal Generator (whether addressed to listen or to talk), it responds to the Clear Lockout and Set Local command by re-enabling the front-panel Local push button and returning from remote control to local control.
***Require Service.*** Regardless of the addressed state of the Signal Generator (whether addressed to listen or to talk), it can send the Require Service message.
***Status Byte.*** When addressed to talk, after receiving the Serial Poll Enable (SPE) bus command, the Signal Generator outputs the Status Byte.
***Abort.*** Regardless of the addressed state of the Signal Generator (whether addressed to listen or to talk), it responds to the Abort command and stops listening or talking.
***HP-IB Capabilities Local Mode.*** Besides having the above capabilities while remote, the following capabilities are also available from the local mode:

- Require Service
- Status Byte
- Data (Output)

## Table 1-4. HP-IB Capability Reference Table

| HP-IB Capability | Applicable | Response | Related Commands and Controls* | Interface Functions* |
|---|---|---|---|---|
| Data | Yes | All front-panel functions, special functions, and remote- only functions are programmable (except Knob Rotation). The Signal Generator can send status byte, message, and setting information. The front-panel LSTN and TLK annunciators turn on as appropriate when the instrument is addressed. | MLA<br>MTA<br>EOI | T6<br>L3<br>AHI |
| Trigger | No | The Signal Generator does not have a device trigger capability. | GET | DTO |
| Clear | Yes | The Signal Generator responds equally to DCL and SDC bus commands. The Clear capability does not reset instrument parameters. | DCL<br>SDC | DC1 |
| Remote | Yes | The Signal Generator's remote mode is enabled when the REN bus line is true. However, it remains in local (i.e., the keyboard is active) until it is first addressed to listen. The output signal is unchanged when the Signal Generator enters the remote mode. The front- panel RMT annunciator turns on when in remote mode. | REN<br>MLA | RL1 |
| Local | Yes | The Signal Generator returns to front-panel control when it enters the local mode. The output signal is unchanged. Responds either to the GTL bus command or the front-panel LOCAL key. The LOCAL key will not work if the instrument is in the Local Lockout State. | GTL | RL1 |
| Local Lockout | Yes | Local Key is disabled during Local Lockout so only the controller or the POWER switch can return the Signal Generator to local. | LLO | RL1 |
| Clear Lockout/ Set Local | Yes | Generator returns to local and Local Lockout is no longer true when the REN bus lines goes false. | REN | RL1 |
| Pass Control/ Take Control | No | The Signal Generator cannot pass or take control of HP-IB. However it does have limited control capability that is intended for servicing the instrument. This control capability is accessed with Service Special Functions. | ATN<br>IFC | C1<br>C2<br>C3<br>C28 |
| Require Service | Yes | The Signal Generator sets the SRQ bus line true if one of the following conditions exists and it has been enabled by the RQS mask to send the message for that condition: Parameter Changed, Error, Ready, Local/Remote, Execution Error, Hardware Error, or End of Sweep. | SRO | SRI |
| Status Byte | Yes | The Signal Generator responds to a Serial Poll Enable (SPE) bus command by sending an 8-bit byt3 when addressed to talk. Bit 6 (ROS bit) is true if Signal Generator had sent the Require Service Message. Each bit requires different conditions for clearing. | SPE<br>SPD<br>MTA | T6 |
| Status Bit | No | The Signal Generator does not respond to a parallel poll. | ATN<br>EOI | PPO |
| Abort | Yes | The Signal Generator stops talking or listening. | IFC | T6, L3 |

Commands, Control lines and Interlace Functions are defined in IEEE Std 488 (and the identical ANSI Standard MCt.1). Knowledge of these might not be necessary it your controller's manual describes programming in terms of the twelve HP-IB Messages shown in the left column

Complete HP-IB capability as defined in IEEE Std 488 (and the identical ANSI Standard MC1.1) is: SH1, AH1, T6, TE0, L3, LE0, SR1, RL1, PP0, DC1, DT0, C1, C2, C3, C28, E2.

***DATA INPUT***

Data can be input to the Signal Generator using either front-panel keystrokes or via HP-IB.

To address the Signal Generator via HP-IB, the input data information usually contains the universal unlisten command, the Signal Generator's listen address, the controller's talk address, and a string of HP-IB program codes. As an example to set frequency to 123.4MHz (HP BASIC):

```
OUTPUT 719;"FR 123.4MZ"
```

Refer to your controller manual for command syntax and the controller's address.

***Program Codes.*** The Signal Generator's functions can be accessed with specific program codes. These program codes are summarized in Signal Generator Function to HP-IB Code in Table 1-10, and Signal Generator HP-IB Code to Function in Table 1-11. In addition, most HP-IB codes are printed on the instrument's front panel, in light gray print, near the code's associated push button.

***Input Syntax.*** Input data information consists of one or more bytes sent over the bus' eight data lines when the bus' attention control line (ATN) is false, and when the Signal Generator is remote and addressed to listen with the REN line true (low). The Signal Generator processes ASCII characters individually as they are received and performs the function specified as soon as a recognizable sequence of characters has been received.

Accessing the Signal Generator's front-panel key functions via HP-IB is equivalent to accessing them from the front-panel. Table 1-5 compares some local keystroke sequences and their corresponding HP-IB code sequences. (Direct access to the shift functions is possible from HP-IB so the Shift push button is not used in HP-IB coding.)

**Table 1-5. Relationship Between Keystrokes and HP-IB Code Sequences**

| **Function** | **Front-Panel Keystroke Sequence** | **HP-IB Sequence** |
|---|---|---|
| To set a 1 MHz RF output frequency | FREQ 1 MHZ<br>V | FR 1 MZ |
| To set an RF frequency reference of 1 MHz | FREQ REF SET ( SHIFT FREQ ) 1 MHZ | FRRS 1 MZ |
| To select Special Function 111 | SPCL ( SHIFT - ) 1 1 1 | SP 111 |

***DATA INPUT-Continued***

***Sequence Dependency.*** Some functions in the 8642 are coupled together because of internal circuit configuration limitations. This coupling can limit the execution of a setting when one function limits the setting of the other.

For example, amplitude and AM depth are coupled functions; An AM depth of 99.0% is possible only when the amplitude setting is between -140.0 and +14.0 dBm. Therefore,

| | |
|---|---|
| changing this setting: | Amplitude = +14 dBm,<br>AM depth = 99% |
| to this setting: | Amplitude= +15 dBm,<br>AM depth = 75% |

would not be possible if the amplitude entry was attempted before the AM setting. AM could be changed first to achieve the setting, but setting AM first would not always be successful. For example, if you were changing back to the first example (to an amplitude of +14 dBm and AM depth of 99%), setting the AM first would not set the requested AM setting. (To eliminate this sequence dependency problem when setting AM or amplitude, first turn off AM, then set the amplitude, then set the AM depth.)

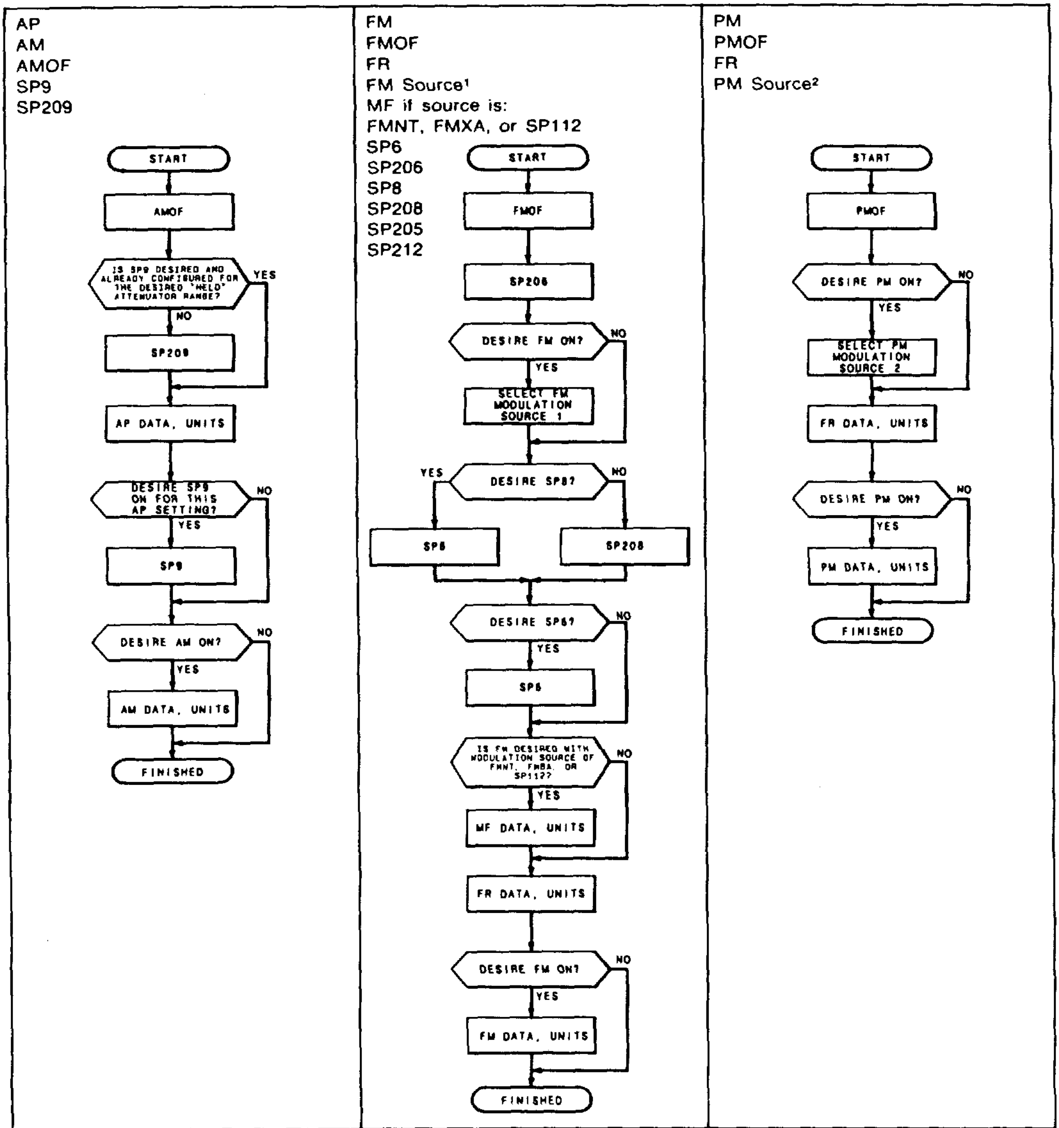
***How to Avoid Sequence Dependency Problems.*** The Operating Instructions describe the limitations of specific coupled functions and will help you avoid entering incorrect sequences. Also, when operating locally, displayed Execution Error messages direct you to your entry error. However, if operating via HP-IB, it might be inconvenient to rely either on the manual or on error messages for every combination of settings. Flowcharts of Sequence Dependency can assist in the development of driver subprograms to eliminate the consequences of sequence dependency. If you follow the flowcharts and still cannot obtain the requested setting, that setting is probably not possible.

When setting one or more of the following, use the appropriate flowchart:

***Exceptions to Flowcharts.*** Not covered in those flowcharts is frequency sweep's dependence on entry sequence. Frequency sweeps are coupled to FM and OM settings. When selecting either Digitally Stepped Frequency Sweep or Phase Continuous Frequency Sweep with either FM or OM, use the following sequence:

1. Turn off frequency sweep (FAOF FBOF).
2. Select either Special Function 123 (Phase Continuous Frequency Sweep) or Special Function 223 (Phase Continuous Frequency Sweep Off which enables the selection of Digitally Stepped Frequency Sweep).
3. If FM is to be selected, use the FM flow chart (but don't set FM yet, nor FR).
4. If OM is to be selected, use the OM flowchart (but don't set PM yet, nor FR).
5. With Start Frequency (FA) or Stop Frequency (FB) active, select the sweep mode (FASA for auto, FASM for manual, or FASG for single).
6. Select the sweep time setting.
7. Select either the start or stop frequency setting. (Choose the frequency setting that is in the band that allows the desired FM or OM setting.) 8. Select the desired FM or OM deviation setting.
9. Select either the stop or start frequency setting (whichever of these that was not set in step 7).

When setting one or more of the following, use the appropriate flowchart:




[1]FM Modulation Sources include: FMNT, FMXA, FMXD, FMBA, FMBD, SP5, SP112

[2]ΦM Modulation Sources include: PMNT, PMXA, PMXD, PMBA, PMBD.

**Figure 1-5. Flowcharts for Sequence Dependency**

***DATA INPUT-Continued***

***Valid Character Entry.*** When entering data over HP-IB, the data entry can take the form of:

Implicit point notation (for example, 100 MZ), or
Fixed Point notation (for example, 100.0 MZ), or
Exponential notation (for example, 100OE-1 MZ).

Each function has an HP-IB data-entry limit of 10 mantissa digits and 2 exponential digits (exponential notation is optional). For example, the following entries for 100 MHz will be accepted:

1000000000E-01 HZ
1000000000E-1 HZ
1000000000E-4 KZ

However, these entries for 100 MHz will not be accepted:

10000000000E-02 HZ (this entry will be accepted as 10 MHz)
100000000E-006 MZ (this entry won't be accepted and could cause problems in subsequent data entries)

Only the following data inputs are recognized over HP-IB by the Signal Generator; all other characters are ignored:

A-Z, a-z (lower-case letters are converted to upper case)
0-9
. + -
Leading zeros are treated as significant digits.
The space character, carriage return, and line feed are ignored.

***DATA OUTPUT***

The Signal Generator can send the following data messages when it is addressed to talk:

Status Byte (refer to Status Byte in this paragraph)
Messages (discussed below)
Display Information (discussed below)
Service Messages (refer to Section In specific Service Message information)

The Signal Generator can output the following messages and display information (normally viewed on the front-panel display) using HP-IB codes that do not have equivalent front-panel keys. The HP-IB codes are in parenthesis after each message listed below:

Output Messages
- Hardware Errors (OH)
- Execution Errors (OE)
- Parameters Changed Messages (OC)

Output Active Function (OA)
Output HI, I.O Status (OL)
Output Display (Output Display is the default HP-IB output when nothing else is configured for data output; it does not require an HP-IB code to output data.)

***Output Messages***

***Hardware Errors (OH).*** These messages signal the presence of either an internal circuit hardware problem or a firmware problem. (Refer to Operator Messages, in this section, for more information about these messages. Each message code is prefixed with the letter "H" in the listing in that section.)

The presence of one or more of these messages is signaled when bit 1 of the Status Byte is set. Some service-related messages can also cause this bit to be set.

***Execution Errors (OE).*** These messages describe the Signal Generator's reason for not executing an attempted setting. (Refer to Operating Messages, in this Section, for more information about these messages. Each message code is prefixed with the letter "E" in that listing.)

The presence of one of these messages is signaled when bit 2 of the Status Byte is set. Some service-related messages can also cause this bit to be set.

***Parameters Changed Messages (OC).*** These messages inform you that the Signal Generator has changed some other setting to allow a new setting. Some of the Signal Generator's functions cannot occur simultaneously with other functions, so the Signal Generator will automatically adjust or turn off the functions that are preventing the new setting. For example, AM is turned off when pulse modulation is selected; the Output Parameters Changed Message is "AM TURNED OFF .C11". (Refer to Operating Messages, in this Section, for more information about these messages. Each message code is prefixed with the letter "C" in that listing.) The presence of this message is signaled when bit 7 of the Status Byte is set. Some service-related messages can also cause this bit to be set.

Examples
The Signal Generator can output either the message code number or the message string (the alphanumeric display) for any of the above messages. Table 1-8, Error Code and Message Recovery Example Program, provides some sample subprograms that detail a way to retrieve the Signal Generator's messages.

***Execution Errors and Parameters Changed Messages.*** After it receives "OE" or "OC" and is addressed to talk the first time, the Signal Generator will output the message code number. The second time it is addressed to talk, the Signal Generator will output the message string.

You can read only the first Execution Error message if more than one of these has occurred since either the Status Byte was cleared or since the last time "OE" was executed. Then reading a message using "OE" will enable you to read out only the first Execution Error message.

You can read only the first Parameters Changed message if more than one of each of these has occurred since either the Status Byte was cleared or since the last time "OC" was executed. Then reading a message using "OC" will enable you to read out only the first Parameters Changed message.

***Output Messages-Continued***

Following is a programming example in BASIC for outputting an Execution Error (OE):

Output either an Execution Error code number or message string from the Signal Generator (address 19) and reset bit 2 of the Status Byte:

To output the message code number:

```
10  OUTPUT 719; "OE"
20  ENTER 719; A
```

To output the message string:

```
10  OUTPUT 719; "OE"
20  ENTER  719; A        !  Dummy read of the message code number
30  ENTER 719; A$
```

The above examples can also be modified to apply to an Output Parameters Changed (OC) message if you send "OC" instead of "OE". Sending either "OE" or "OC" alone (program line 10 above) will reset the appropriate status bit (unless RQS is true, in which case the Status Byte must be read again to clear the status bit).

Note that you should not execute an instrument function between setting up the instrument for data output and reading the data from the Signal Generator. To illustrate this consideration, refer to the "OE" example above. If you were to insert a line 15 that set an instrument function such as AM, the data received from the Signal Generator will be the display data, not the Execution Error message code, because "AM" would have superceded the "OE" data output preparation.

***Hardware Errors.*** Hardware Error messages are handled differently than Execution Error or Parameters Changed messages since more than one message can be present. These messages are stored as a queued up list with a maximum number of 22 messages. To properly retrieve all the queued up messages, follow the "OH" command with a software loop as shown in the sample program in Table 1-8.

***Output Active Function (OA).*** Output Active Function enables the Signal Generator to output the setting of a selected active function over HP-IB. The Signal Generator outputs a string that can be directly read into a numeric variable or into a string variable which includes the HP-IB codes for both the function and its units specifier (maximum of 19 characters).

Following is a programming example in BASIC for outputting the active function (OA):

Output the RF frequency setting as either a numeric value or a string from the Signal Generator (address 19). ("OA" should be preceded by the function's HP-IB code.)

To output the numeric value:

```
10 OUTPUT 719; "FROA"
20  ENTER  719; V      !  Value  is output  in Hz.
```

To output the alphanumeric character string:

```
10 OUTPUT 719; "FROA"
20  ENTER  719; A$
```

**Output Messages-Continued**

The functions and values that can be output over HP-IB using "OA" are listed below along with some format parameters.

Meanings of Values That Could Be Output

-200 indicates the function is off.

-201 indicates RF OFF (for amplitude only).

-202 indicates reverse power is tripped (for amplitude only).

A space character is placed before and after the numeric portion of the string.

**Output String Formats**. Table 1-6, Output Active Function String Formats (on the following page), lists the output format for each active function string.

The meanings of symbols in Table 1-6 are as follows:

s = sign character, either "+" or "-"

d = digit (Leading zero digits greater than the one's digit are suppressed.)

If a function's value is in relative units, the displayed, relative setting (not the absolute setting) will be output. You can output absolute units by converting from relative units to absolute units before outputting the active function.

"OA" can be sent without a function prefix. The first two characters in the output string will designate the active function. If the Signal Generator does not have an active function when it receives "OA" without a function prefix, it will output the display string (which is the default HP-IB output)

**Table 1-6. Output Active Function String Formats**

| Function | String Formal |
|---|---|
| Frequency<br>(Value could be negative<br>if Frequency is relative) | FR sdddddddddd.0 HZ |
| Amplitude | |
| (in dBm) | AP sddd.d DM |
| (in dB relative.<br>dB EMF relative, dB,V,<br>or dB EMF UV) | AP sddd.d DB |
| (in volts or EMF volts) | AP +d.dddddddd VL |
| AM | AM +dd.d PC |
| FM | FM +ddddddd.O HZ |
| ΦM | PM +ddd.dddddd RD |
| Modulation Frequency | MF +dddddd.d HZ |
| Modulation Output Level | ML +d.dddd VL |
| Start Frequency | FA +dddddddddd.O HZ |
| Stop Frequency | FB +dddddddddd.O HZ |
| Start Amplitude | |
| (in dBm) | AA sddd.d DM |
| (in volts or EMF volts) | AA +d.dddddddd VL |
| Stop Amplitude | |
| (in dBm) | AB sddd.d DM |
| (in volts or EMF volts) | AB +d.dddddddd VL |
| Sweep Time | ST +ddd.ddd SC |
| Leading zero digits greater than the one's digit are suppressed. | |

**Output Messages-Continued**

**Output HI, LO Status (OL).** Output HI, LO status enables an HP-IB Controller to monitor the level of the external modulation signal by configuring the Signal Generator to output the status of the HI, LO annunciators for AM, FM, or ∅M. The status can be read as either a numeric value or as a string that represents the HI and LO annunciators.

| Annunciator | Numeric Value Representation | String Representation |
|---|---|---|
| **HI** | **+1** | **HI** |
| **LO** | **-1** | **LO** |
| **neither HI no LO** | **0** | **OK** |

Following is a programming example in BASIC for outputting HI, LO status (OL):

Output from the Signal Generator (address 19) the status of its HI, LO annunciators for an external, ac-coupled AM signal.

To output the numeric value:

```
10 OUTPUT  719;  "AMOL"
20 ENTER 719; V
```

To output the string:

```
10  OUTPUT  719;       "AMOL"
20 ENTER 719;V                        !   Dummy read of the numeric value
30 ENTER 719; A$
```

***Output Display Information*.** The Signal Generator will output the display information when it is addressed to talk and is not configured to output any other data.

1. The first time the Signal Generator is addressed to talk, it will output the actual display in alphanumeric characters (maximum of 74 characters). (The string length of the alphanumeric display will always be greater than or equal to 25 characters.)
2. The second time the Signal Generator is addressed to talk, it will output a number, representing the displayed cursor positions, in a binary, weighted sum. (This string length will always be less than 25 characters.)
3. The third time the Signal Generator is addressed to talk, it will output a number, representing the displayed annunciators, in a binary, weighted sum. (This string length will also always be less than 25 characters.)

Each item in the sequence above will be output again in the same sequence when the Signal Generator is further addressed to talk.

Following is a programming example in BASIC for outputting display information:

Output the current display of the Signal Generator (address 19), including the cursor position and annunciators. (Assuming a function was executed to enable you to get the display you want.)

```
10  DIM  A$S [74]       !  Define string big  enough  to handle maximum display
20  ENTER  719; A$      !   Display String
30  ENTER  719; C       !   Cursor Value
40  ENTER  719; N       !   Annunciator Value
```

***Output Messages-Continued***

The Signal Generator is initialized to output the alphanumeric display string first, whenever you execute an instrument function (for example, set AM or frequency). (When you are using Output Display to output messages, the actual front-panel display will be output, not the message code number that would be output if you used "OC", "OE", or "OH".)

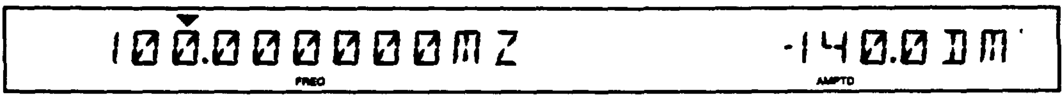
The binary weight of the cursor positions are:

$2^1$=2 for the left most cursor, $2^2$=4 for the next cursor to the right, $2^3$=8 for the next cursor to the right, ..., $2_n$ for the nth cursor position from the left, ..., $2^{25}$=33 554 432 for the right most cursor.

The binary weight of the annunciators are provided in Table 1-7.

Example

With a display of:




Alphanumeric characters output will be:
100.000000MZ  -140.0DM

Cursor value output (4th cursor from the left) will be:
$2^4$ = 16
Annunciator value output for FREQ and AMPTD will be:
$2^5+2^{20}$ = 32 + 1 048 576 = 1 048 608

Outputting the display could be used to output the currently selected special functions, or to output the annunciator value to determine the current modulation source.

***CLEAR***

The Signal Generator responds identically to Selected Device Clear (SDC) and Device Clear (DCL) bus commands by clearing any message or uncompleted entries. For example, a command of FR 100 would be cleared because no units terminator has been specified.

Also, with the Clear command, Clear Status Byte occurs, possibly clearing up to 6 status bits.

The Clear command does not affect instrument settings. However, selecting Instrument Preset (IP), Partial Preset (PP), or turning the Power from Standby to On, will reset instrument settings as described in the Operating Instruction, Instrument Preset, Partial Preset.

**Table 1-7. Output Display; Binary Weight of Annunciators**

| Annunciator | Weighting | Decimal |
|---|---|---|
| RMT | $2^0$ | 1 |
| LSTN | $2^1$ | 2 |
| START (Frequency) | $2^2$ | 4 |
| TLK | $2^3$ | 8 |
| SRQ | $2^4$ | 16 |
| FREQ | $2^5$ | 32 |
| REL (Frequency) | $2^8$ | 64 |
| EMF | $2^7$ | 128 |
| SPCL | $2^8$ | 256 |
| SWPNG | $2^9$ | 512 |
| HI | $2^{10}$ | 1 024 |
| LO | $2^{11}$ | 2 048 |
| IM | $2^{12}$ | 4 096 |
| FM | $2^{13}$ | 8 192 |
| AM | $2^{14}$ | 16 384 |
| START (Amplitude) | $2^{15}$ | 32 768 |
| INT | $2^{16}$ | 65 536 |
| EXT | $2^{17}$ | 131 072 |
| AC | $2^{18}$ | 262 144 |
| DC | $2^{19}$ | 524 288 |
| AMPTD | $2^{20}$ | 1 048 576 |
| REL (Amplitude) | $2^{21}$ | 2 097 152 |
| STOP | $2^{22}$ | 4 194 304 |
| MSSG | $2^{23}$ | 8 388 608 |

***REMOTE, LOCAL***

***Local to Remote Transition.*** The Signal Generator goes remote when it receives the Remote message. The Remote message has two parts:

1. Remove Enable bus control line (REN) set true.
2. Device listen address received once (while REN is true).

The Signal Generator's output signal and all control settings remain unchanged with the local to remote transition, but any uncompleted messages (non-terminated partial entries) are cleared.

***Remote to Local Transition.*** The Local message is the way the controller sends the Go To Local (GTL) bus command. The Signal Generator returns to local control when it receives the Local or Clear Lockout/Set Local message. The Signal Generator also returns to the local mode when the front-panel LOCAL push button is pressed (provided Local Lockout is not in effect). If the instrument is not in local lockout mode, pressing the front-panel LOCAL push button could interrupt a data transmission and suspend the Signal Generator in an unknown state.

## Table 1-8. Error Code and Message Recovery Example Program

```
10   !    ERROR CODE AND MESSAGE RECOVERY EXAMPLE PROGRAM
20   !        JWT JULY 1984
30   !        EDIT DATE 23 AUG 1984
40   !
50   LET Gen=719                                              DEFINE 8642 ADDRESS
60   !
70   COM /Gen-addr/ Gen                                   !   COMMON AREA TO STORE
80   !                                                        GEN ADDRESS FOR SUB'S
90   1
100  DIM Mssg $ [74]                                      !   DIMENSION SPACE TO
110  !                                                        ENTER IN MESSAGES
120  !
130  ENABLE INTR 7;2
140  ON INTR 7 CALL Get-message
150  OUTPUT Gen;"RM134HZ"
160  !
170  !
180  !
200  CALL User-program
210  !
220  !
230  !
240  !
250  !
260  END
270  !
280  !    SUB PROGRAMM TO POLL THE 8642
290  !    AND PRINT THE MESSAGE CODES
300  !
310  Get.message:         SUB Get-message
320                       CON /Gen.addr/ Gen
330                       LET Byte=SPOLL (Gen)                    !   READ STATUS BYTE
340                       IF BIT(Byte,Z) THEN CALL Execution  !   CHECK MESSAGE BIT
350                       IF BIT(Byte,7) THEN CALL Change         !   CHECK MESSAGE BIT
360                       IF BIT(Byte,1) THEN CALL Hardware   !   CHECK MESSAGE BIT
370  ENABLE INTR 7
380                       SUBEND
390                       !
400                       !
410  Execution: SUB Execution
420                 COM /Genaddr/ Gen
430                 OUTPUT Gen;"OE"                               !   OUTPUT"OE"COMMAND
440                 ENTER Gen;Mssg.code                           !   READ MESSAGE CODE
450                 PRINT USING 460;Mssg-code                     !   PRINT MESSAGE CODE
460                 IMAGE "EXECUTION ERROR CODE =",K
470                 ENTER Gen;Mssg $ [1,74)                       !   READ MESSAGE
480                 PRINT Mssg $ [,74]                            !   PRINT MESSAGE
490                 SUBEND
500                 !
510  Change:       SUB Change
520                 COM /Gen-addr/ Gen
530                 OUTPUT Gen;"OC"                               !   OUTPUT"OC"COMMAND
540                 ENTER Gen;Mssg-code                           I   READ MESSAGE CODE
550                 PRINT USING 560;Mssgcode                      !   PRINT MESSAGE CODE
560                 IMAGE "CHANGE CODE =",K
570                 ENTER Gen;Mssg $ [1,74]                       !   READ MESSAGE
580                 PRINT Mssg & [1,74]                           !   PRINT MESSAGE
590                 SUBEND
600                 !
610  Hardware: SUB Hardware
620                 COM /Gen-addr/ Gen
630                 OUTPUT Gen;"ON"                               !   OUTPUT"OH"COMMAND
640                 ENTER Gen;Mssg-code                           !   READ MESSAGE CODE
650                 IF Mssg.code<>O THEN 690                      !   CHECK IF CODE =O
660                 ENTER Gen;Mssg-code                           i   READ MESSAGE CODE
670                 PRINT "NO HARDWARE MESSAGE FOUND"             !   PRINT NO MESSAGES
680                 GOTO 760
690                 PRINT "MESSAGE CODE =";Mssg.code              !   PRINT MESSAGE CODE
700                 ENTER Gen;Mssg.code                           !   READ MESSAGE CODE
710                 IF Mssg-code<>O THEN 690                      !   CHECK IF LAST
720                 ENTER Gen;Mssg $ [1,74]                       !   READ MESSAGE
730                 PRINT Mssg $ [1,74]                           !   PRINT MESSAGE
740                 IF Mssg $ [1,19]="END OF MESSAGE LIST" THEN 760   !   LAST MESSAGE ?
750                 GOTO 720                                      !   GO FOR NEXT MSGE
760                 SUBEND
```

***LOCAL LOCKOUT, SET LOCAL***

***Local Lockout.*** The Local Lockout message is the way the controller sends the (LLO) bus command. The Signal Generator responds to the Local Lockout message by disabling the front-panel LOCAL push button.

***Clear Lockout/Set Local.*** The Clear Lockout/Set Local message is the way the controller sets the Remote Enable (REN) bus control line false. The Signal Generator returns to local mode when it receives the Clear Lockout/Set Local message. No instrument settings are changed by the transition from remote to local.

When in local lockout, the Signal Generator can be returned to local only by the controller (using the Local or Clear Lockout/Set Local messages), or by setting the Power switch to Standby and back to on, or by removing the bus cable.

**NOTE**

**Return-to-local while in local lockout can be accomplished by switching the POWER from STBY to ON. Returning to local control in this way has the following disadvantages:**

**• It defeats the purpose and advantages of local lockout (that is, the system controller will lose control of a system element).**

**• Instrument configuration is reset to the power-up conditions.**

***SERVICE REQUEST***

The Signal Generator uses its internal Status Byte and a Request Service Mask Byte (RQS mask that you set) to issue a Service Request (SRQ bus line true).

***RQS MASK.*** The RQS mask is an 8-bit byte that you can set to define which bits of the Status Byte will be allowed to cause a service request. (See Figure 1-6.) Bits 0 through 5 and 7 of the Status Byte are logically ANDed with bits 0 through 5 and 7 of the RQS mask byte. If the resultant value is not equal to zero, the Signal Generator sets bit 6 of the Status Byte true, which sends a Service Request (SRQ) message to the system controller (SRQ bus line true).

At turn-on or instrument preset, the RQS mask byte is set to zero, effectively disabling or masking all the status bits from causing a service request message.

Changing the 8-bit RQS Mask Byte

1. From the Remote Mode:
   - Send RM, the decimal equivalent of the binary 8-bit byte (a number between 0 and 255), and the terminator, HZ.

***SERVICE REQUEST-Continued***

2. From the Local Mode:
   - Select RQS MASK (SHIFT INT), the decimal equivalent of the binary 8-bit byte and any terminator (such as HZ µV).

Example

Enable status bits 0 (End of Sweep), 1 (Hardware Error), and 7 (Parameters Changed) to cause a service request (SRQ bus line true) by unmasking those bits; that is, set the Signal Generator's RQS mask to binary 10000011 (decimal 131).

| | |
|---|---|
| Set the mask value to: | binary 10000011 = decimal 131 |
| Local operation: | Press RQS MASK (SHIFT INT) 1 3 1 HZ .µV |
| Remote operation: | RM 131 HZ |

A Service Request can be generated in either the local or remote mode. To determine which status bit caused the service request, refer to Table 1-9, HP-IB Status Byte Bit Definitions. The Status Byte can be read only by doing a serial poll via HP-IB.

Clearing the Service Request Message. The Service Request message can be cleared by masking the "set" bits in the Status Byte using the RQS mask. If the condition which caused SRQ to be pulled has been resolved, the Service Request message can be cleared with any of the following actions for clearing the Status Byte:

Sending Clear Status (CS).
Sending Instrument Preset (IP).
Sending Device Clear or Selected Device Clear.
Switching Power from Standby to On.
Resetting the individual "set" bits. (Refer to Table 1-9.)

***STATUS BYTE***

The 8642 Status Byte consists of one 8-bit byte which reflects Signal Generator status. All 8 status bits are updated whether the Signal Generator is in local or remote mode.

Each bit of the Status Byte monitors a particular aspect of the Signal Generator's operation. Table 1-9, HP-IB Status Byte Bit Definitions, details the operating conditions which are monitored by the 8642 Status Byte.

The Status Byte can either be used to cause a Service Request or simply be read to monitor the Signal Generator's operating status.

***Reading the Status Byte.*** To read the Signal Generator's Status Byte, the controller must send the Serial Poll Enable bus command and address the Signal Generator to talk. For example:

Program Statement (in BASIC)

**10 S = SPOLL (719)**

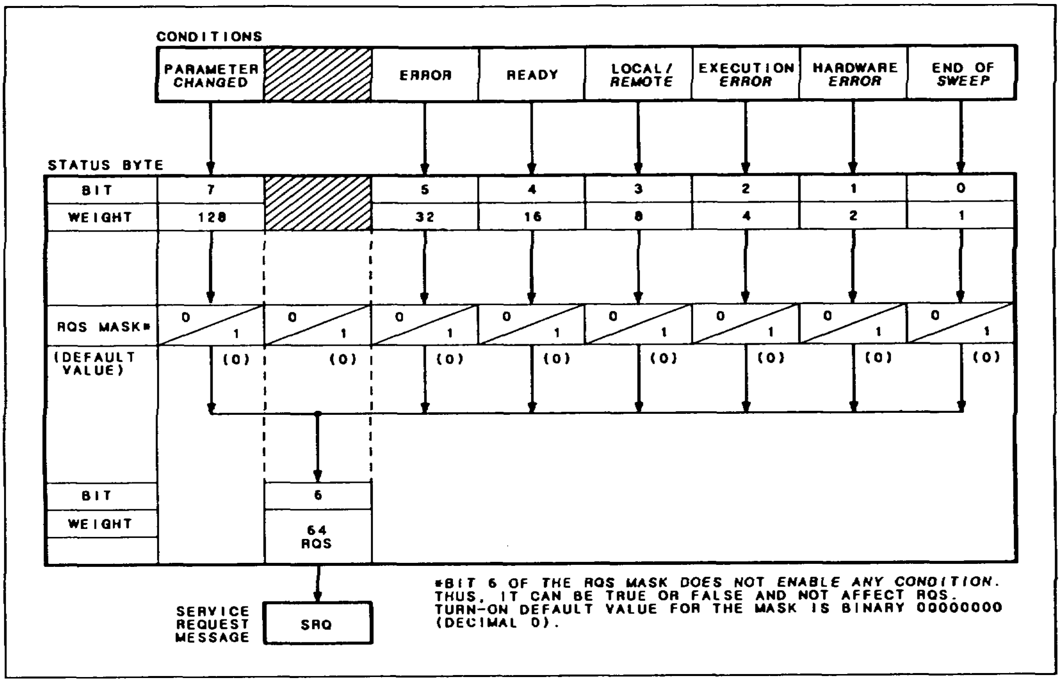



**Figure 1-6. The Status Byte and RQS Mask.**

If the RQS bit is not set, the Status Byte will reflect the current status of the instrument. If the RQS bit is set, the Status Byte will reflect the status of the instrument when the RQS bit was first set (or when the Status Byte was last read with RQS set). To actually get the current status of the instrument, the Status Byte should be read again. Note that the act of reading the Status Byte (alone) does not clear any status bits.

***Clearing the Status Byte.*** If the instrument does not have an unresolved hardware error, the Status Byte will be "cleared" by executing any of the following:

Sending Clear Status (CS).
Sending Instrument Preset (IP).
Sending Device Clear or Selected Device Clear.
Switching the Power from Standby to On.

You can also clear the Status Byte by clearing the individual status bits. Refer to Table 1-9.

**NOTE**

**Bits 3 (Local/Remote) and 4 (Ready) are not affected by "clearing" the Status Byte. They always output their actual values.**

**Table 1-9. HP-IB Status Byte Bit Definitions**

| Bit | HP-IB Operating Condition | Condition | Comments |
|---|---|---|---|
| 0 | END OF SWEEP | Single sweep finished. | Reset with auto, manual, or a new single sweep, or sweep mode off.[1, 2] |
| 1 | HARDWARE ERROR | Instrument out-of-lock, reverse-power tripped, or instrument firmware malfunction. | Reset with an Output Hardware Error message to the 8642A/B (HP-IB program code "OH").1, 2 More than one Hardware Error message may be present. After "OH" is executed, one error message code or string is output with each address to talk. (The Detailed Operating Instruction, **Messages**, lists the error codes with their respective messages.) To properly retrieve all Hardware Error information, refer to the example program in **Data Output** in this HP-IB information section. |
| 2 | EXECUTION ERROR | Syntax or function execution error. | Reset with an Output Execution error message to the 8642A/B (HP-18 program code DOE"). 1, 2 Error code that caused bit to be set can be determined by reading the Output Execution Error code or string. Refer to the example program in **Data Output** in this HP-IB information section. |
| 3 | LOCAL/REMOTE | Instrument in local operation. | Reset when remote. Can be used to detect a front-panel SRO (emulated by selecting the LOCAL key if not in Local Lockout).2 |
| 4 | READY | Typically always set. | The Status Byte must actually be read with this bit set for the instrument to have completed the processor delay time part of the setting change which might not include the analog settling time. |
| 5 | ERROR | Logical OR of bits 1 and 2. | Reset when bits 1 and 2 are reset.1 |
| 6 | ROS (IEEE-488) | ROS mask is ANDed with the Status Byte and the result is not equal to 0 (refer to Service Request for more information) | Reset when the ROS mask ANDed with the Status' Byte (ignoring bit 6) equals 0. |
| 7 | PARAMETER CHANGED | Previous setting has been automatically changed; for example, FM is turned off when IM becomes active. | Reset with an output Parameter Changed message (HP-IB program code “OC"). 1, .2 Parameter that was changed can be determined by transmitting the Output Parameter Changed message code or string. Refer to the example program in **Data Output** in this HP-IB information section. |

[1] Also reset with IP. CS. Device Clear, Selected Device Clear, Power On. (Bit 1 is cleared only if all hardware errors are resolved.)

[2] If that bit was causing SRO to be pulled. you must also read the Status Byte again to actually reset that bit (This second reading will still show the error because the error is cleared only after the reading.)

### *SYSTEM CONTROLLER*

The 8642 can be configured to perform as a system controller when in its service mode of operation. Perform the following steps to configure the 8642 to output test results to a printer connector to the HP-IB Interface connector:

1. Press SHIFT, -, then number 3 push buttons.
2. Press 8, 8, then Hz push buttons.
3. Press 3, 3, 0, then Hz push buttons.
4. System Controller is now activated.
5. Press 8, 9, then Hz push button to deactivate.

## *ADDITIONAL HP-IB INFORMATION*

***Abort.*** Abort abruptly terminates all listener/talker activity on the interface bus, using the Interface Clear (IFC) bus line, and prepares all instruments to receive a new command from the controller. Typically this is an initialization command used to place the bus in a known starting condition. The Signal Generator stops talking or listening when it receives the Abort message.

***Trigger.*** The Signal Generator does not respond to the Trigger message.

***Status Bit.*** The Signal Generator does not implement parallel poll operations and therefore cannot send a Status Bit message.

***Controller Capabilities; Self Test and Calibration.*** The Signal Generator can be configured as a system controller to perform various self-test and self-calibration routines with a system voltmeter and the HP 8902A Measuring Receiver (and an optional printer).

***Display Control Via HP-IB.*** Selecting the SHIFT key twice when in the local mode will display the instrument settings last selected. In the remote mode, you can send SHSH to achieve this same effect. (This may be useful when outputting display information.)

***Remote Indicators.*** The Signal Generator displays HP-IB annunciators to indicate its current HP-IB status:

RMT When remote operation is selected
LSTN When addressed to listen
TLK When addressed to talk
SRQ When pulling the SRQ line (with the RQS bit set in the Status Byte)

***Disabling the Listen Addressed State*** . The Signal Generator remains addressed to listen until:

It is addressed to talk,
It receives an abort message,
It receives a universal unlisten command, or
Until the Power is switched from Standby to On.

***Disabling the Talk Addressed State.*** The Signal Generator remains addressed to talk until:

It is addressed to listen,
It receives an abort message,
It receives some other device's talk address,
It receives a universal untalk command, or
Until the Power is switched from Standby to On.

## Table 1-10. Signal Generator Function to HP-IB Code

| Parameter | Code |
|---|---|
| **Frequency** | |
| Frequency | FR[1] |
| Start Frequency (Sweep) | FA[1] |
| Stop Frequency (Sweep) | FB[1] |
| **Amplitude** | |
| Amplitude | AP[1] |
| Start Amplitude (Sweep) | AA[1] |
| Stop Amplitude (Sweep) | AB[1] |
| EMF Mode | EMON, EMOF |
| **Modulation** | |
| AM Depth | AM[1] |
| FM Deviation | FM'[1] |
| (M Deviation | PM[1] |
| Pulse | PLON, PLOF |
| **Modulation Oscillator** | |
| Modulation Frequency | MF[1] |
| Modulation Output Level | ML[1] |
| **Modulation Source** | |
| Internal | NT[2] |
| External AC | XA[2] |
| External DC | XD[2] |
| Internal + External AC | BA[2] |
| Internal + External DC | BD[2] |
| **Data** | |
| Numerals 0-9 | 0-9 |
| Decimal point | |
| Back Space | BS |
| **Units** | |
| dBm | DM or DB |
| dB | DB or DM |
| Volt | VL |
| mV | MV |
| µV | UV |
| dBµV | DU |
| GHz | GZ |
| MHz | MZ |
| kHz | KZ |
| Hz | HZ |
| % | PC |

| Parameter | Code |
|---|---|
| Units (Cont'd) | |
| radian | RD |
| second | SC |
| millisecond | MS |
| **Sweep** | |
| Sweep Time | ST[1] |
| Auto Sweep | SA[2] |
| Manual Sweep | SM[2] |
| Single Sweep | SG[2] |
| **Relative** | |
| Reference Set | RS[2] |
| Relative Zero | RZ[2] |
| Relative Off | RF[2] |
| **Other** | |
| Instrument Preset | IP |
| Partial Preset | PP |
| Special Function | SP |
| Message | MG |
| Output Hardware Error | OH |
| Output Execution Error | OE |
| Output Parameters Changed | OC |
| Output Active Function | OA[2] |
| Write Service Request Mask | RM |
| Output HI,LO Annunciator Status | OL[2] |
| Clear Status Byte | CS |
| Step Up | UP[2,.3] |
| Step Down | DN[2,.3] |
| Increment Set | IS[2] |
| Knob, cursor left | KL[2] |
| Knob, cursor right | KR[2] |
| Knob Hold | KHON[2,3] KHOF |
| Knob Increment | KI |
| Help | HP |
| Help Off | HO |
| RF Off/On | R0, R1 |
| Off, On | OF[2], ON[2] |
| Entry Off | EO |
| Sequence | SQ |
| Set Sequence | SS |
| Save | SV |
| Recall | RC |

[1]Active function code.
[2]Function should be preceded by an active function code. For example, internal modulation source for AM is coded AMNT.
[3]These codes will sometimes not need to be preceded by an active function code; for example, when using UP or DN with SV, RC,. HP, or SM.

**Table 1-11. Signal Generator HP-IB Code to Function**

| Code | Parameter |
|---|---|
| AA[1] | Start Amplitude (Sweep) |
| AB[1] | Stop Amplitude (Sweep) |
| AM[1] | AM Depth |
| AP[1] | Amplitude |
| BA[2] | Internal + External AC |
| BD[2] | Internal + External DC |
| BS | Back Space |
| CS | Clear Status Byte |
| DB | dB or dBm |
| DM | dBm or dB |
| DN [2, 3] | Step Down |
| DU | dBµV |
| EMON, | |
| EMOF | EMF Mode |
| EO | Entry Oft |
| FA[1] | Start Frequency (Sweep) |
| FB[1] | Stop Frequency (Sweep) |
| FM[1] | FM Deviation |
| FR[1] | Frequency |
| GZ | GHz |
| HO | Help Off |
| HP | Help |
| HZ | Hz |
| IP | Instrument Preset |
| IS[2] | Increment Set |
| KHON[2], | |
| KHOF | Knob Hold |
| KI | Knob Increment |
| KL[2] | Knob, cursor left |
| KR[2] | Knob, cursor right |
| KZ | kHz |
| MF[1] | Modulation Frequency |
| MG | Message |
| ML[1] | Modulation Output Level |
| MS | millisecond |
| MV | mV |
| MZ | MHz |

| Code | Parameter |
|---|---|
| NT[2] | Internal |
| OA[2] | Output Active Function |
| OC | Output Parameters Changed |
| OE | Output Execution Error |
| OF[2,] | |
| ON[2] | Off, On |
| OH | Output Hardware Error |
| OL[2] | Output HI,LO |
| | Annunciator Status |
| PC | % |
| PLON, | |
| PLOF | Pulse |
| PM[1] | M Deviation |
| PP | Partial Preset |
| R0,R1 | RF Off/On |
| RC | Recall |
| RD | radian |
| RF[2] | Relative Off |
| RM | Write Service Request Mask |
| RS[2] | Reference Set |
| RZ[2] | Relative Zero |
| SA[2] | Auto Sweep |
| SC | second |
| SG[2] | Single Sweep |
| SM[2] | Manual Sweep |
| SP | Special Function |
| SO | Sequence |
| SS | Set Sequence |
| ST[1] | Sweep Time |
| SV | Save |
| UP[2,.3] | Step Up |
| UV | µV |
| VL | Volt |
| XA[2] | External AC |
| XD[2] | External DC |
| 0-9 | Numerals 0-9 |
| | Decimal point |

[1]Active function code.
[2]Function should be preceded by an active function code. For example, internal modulation source for AM is coded AMNT.
[3]These codes will sometimes not need to be preceded by an active function code; for example. when using UP or DN with SV. RC. HP. or SM.

## 1-16. WRITING MESSAGES TO DISPLAY.

You can write messages to the Signal Generator's display using service special functions and ASCII character codes. Two, separate, 49-character message strings can be easily displayed on the front panel or read via HP-IB. Messages such as these could be useful, for example, when keeping track of calibration times, or the owner of the instrument, or special calibration information.

Also, when testing instruments, a message could be used as a system prompt. These messages are battery-backed up and can be stored through power off, to be read any time.

Service Special Functions 653 through 659 manipulate message 1; Special Function 663 through 669 manipulate message 2. Note that accessing service special functions is different than accessing the user special functions discussed previously in this manual.

To select user special functions, you key in SPCL (SHIFT. -) and then the special function number.

To select service special functions locally, you need to follow two steps:

1. First select user Special Function 3, Service Mode, with keystrokes SPCL (SHIFT -) 3. Once you enter the service mode you can access the actual service special functions. However, you can only key in numbers and terminators; selecting any other key will cause the instrument to exit this special mode and display current instrument settings.
2. After you enter the service mode, you can select the service special function number. However, the instrument only knows that you have selected a special function when you key in the HZ µV terminator. For example, to clear the current message in message 1, you would key in 6 5 5 HZ UV.

Table 1-12 lists the special functions that apply to both message 1 and message 2. Table 1-13 provides a list of vaild ASCII character codes.

***Example of entering a user defined message via front panel push buttons:***

1. Press SHIFT, -, then 3 push buttons.
2. Press 6 5 5 then HZ µV push buttons.
3. Press 6 5 6 7 3 then HZ µV push buttons.
4. Press 6 5 6 7 6 then HZ µV push buttons.
5. Press 6 5 6 8 5 then HZ µV push buttons.
6. Press 6 5 6 8 6 then HZ µV push buttons.
7. Press 6 5 6 3 2 then HZ µV push buttons.
8. Press 6 5 6 7 2 then HZ µV push buttons.
9. Press 6 5 6 8 0 then HZ µV push buttons.
10. Press 6 5 4 then HZ TV push buttons.

***Example of entering a user defined message via HP-IB:.*** You can use the following example BASIC program to enter a Message string of 49 characters into Message 1.

```
10   DIM C $ [49]                ! DIMENSION 49 CHARACTER STRING
20   !
30   INPUT C$                    ! INPUT CHARACTER STRING FOR MESSAGE 1
40   !
50   OUTPUT 719;"SP3655EN"       ! CLEAR MESSAGE 1 IN THE 8642A/B
60   !
70   LET L=LEN (C$)              ! DETERMINE LENGTH OF MESSAGE 1
80   !
90   !
100  FOR I=1 TO L                ! CONVERT EACH CHARACTER IN CS TO
110  LET A=NUM (C$ [I,I])        !     ITS EQUIVALENT ASCII NUMERIC
120  OUTPUT 719 USING 130;A      !     CODE
130  IMAGE "SP3656", K, "EN"
140  NEXT I
150  !
160  !
170  OUTPUT 719, "SP3657EN"      ! DISPLAY THE MESSAGE
180  !
190  END
```

***Example of Reading a User-Defined Message Via HP-IB.*** You can use the following example BASIC program to read the Message 1 string.

```
10   DIM C $ [49]                ! DIMENSION 49 CHARACTER STRING
20   UTPUT 719;"SP3657EN"        ! DISPLAY MESSAGE 1
30   NTER 719;C$                 ! READ MESSAGE 1
40   END
```

**Table 1-12. Special Functions that can be Used to Write to the Display**

| Special Functions | | |
|---|---|---|
| **Message 1** | **Message 2** | **Description** |
| 653 | 663 | Underline the characters not yet defined in the message. |
| 654 | 664 | Take out the underlines from the characters not yet defined in the message. |
| 655 | 665 | Clear the stored message to enable writing another message. |
| 656 | 666 | Get ready to write the next sequential character in the message. This special function code is followed by the decimal equivalent of an ASCII character. |
| 657 | 667 | Output the message. This code is used to display the first half of the message. This code is also used to output the entire message via HP-IB. |
| 658 | 668 | Backspace to the previous character in the message. |
| 659 | 669 | Output message. This code is used to display the second half of the message. |

**Table 1-13. ACSII Character Codes**

| ASCII Character | Decimal Equivalent | ASCII Character | Decimal Equivalent | ASCII Character | Decimal Equivalent |
|---|---|---|---|---|---|
| space | 32 | 4 | 52 | H | 72 |
| ! | 33 | 5 | 53 | I | 73 |
| “ | 34 | 6 | 54 | J | 74 |
| # | 35 | 7 | 55 | K | 75 |
| $ | 36 | 8 | 56 | L | 76 |
| % | 37 | 9 | 57 | M | 77 |
| & | 38 | : | 58 | N | 78 |
| , | 39 | ; | 59 | 0 | 79 |
| ( | 40 | < | 60 | P | 80 |
| ) | 41 | = | 61 | Q | 81 |
| * | 42 | > | 62 | R | 82 |
| + | 43 | ? | 63 | S | 83 |
| , | 44 | @ | 64 | T | 84 |
| - | 45 | A | 65 | U | 85 |
| . | 46 | B | 66 | V | 86 |
| / | 47 | C | 67 | w | 87 |
| 0 | 48 | D | 68 | X | 88 |
| 1 | 49 | E | 69 | Y | 89 |
| 2 | 50 | F | 70 | Z | 90 |
| 3 | 51 | G | 71 | | |

# SECTION II. THEORY OF OPERATION

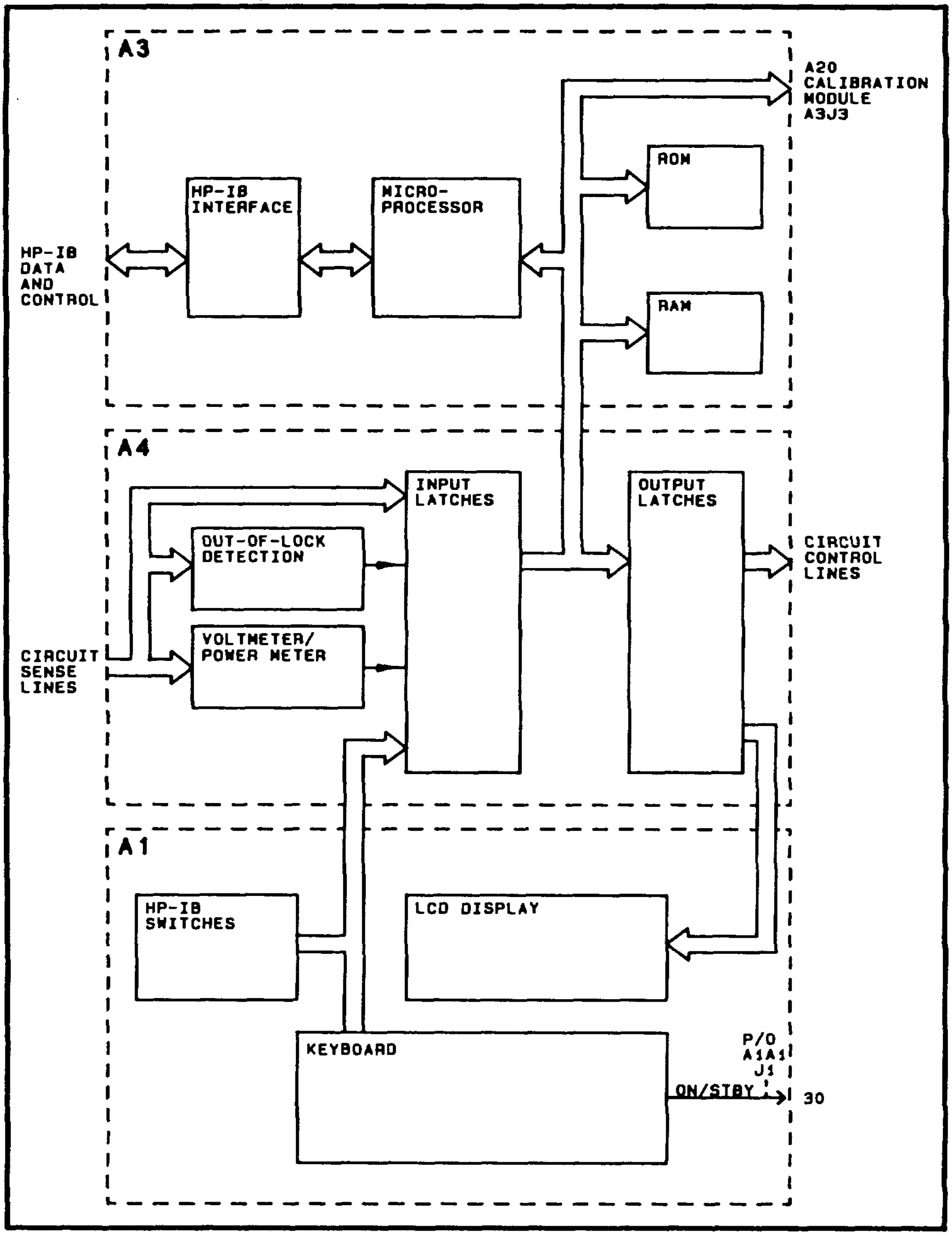
## 2-1. INTRODUCTION.

This section contains the theory of operation for the 8642. Circuit theory and block diagrams are provided for:

- Controller Section (A1, A3, A4)
- A2 Modulation Module
- A6 FM/COUNTER/TIMEBASE Module
- A7 SAWR Loop Module
- A9 IF Loop Module
- A11 Reference Loop Module
- A12 Sum Loop/Divider Module
- A13 Output Filters/ALC Module
- A14 Heterodyne Module
- A17 Regulators/Attenuator Driver Module
- A18 Rectifier/Filter Module
- A19 Doubler Module

See figure 3-100 for an overall block diagram of the 8642.

## A1, A3, A4 MODULE SIMPLIFIED BLOCK DIAGRAM



## A2 THEORY OF OPERATION

### 2-2. A2 MODULATION MODULE

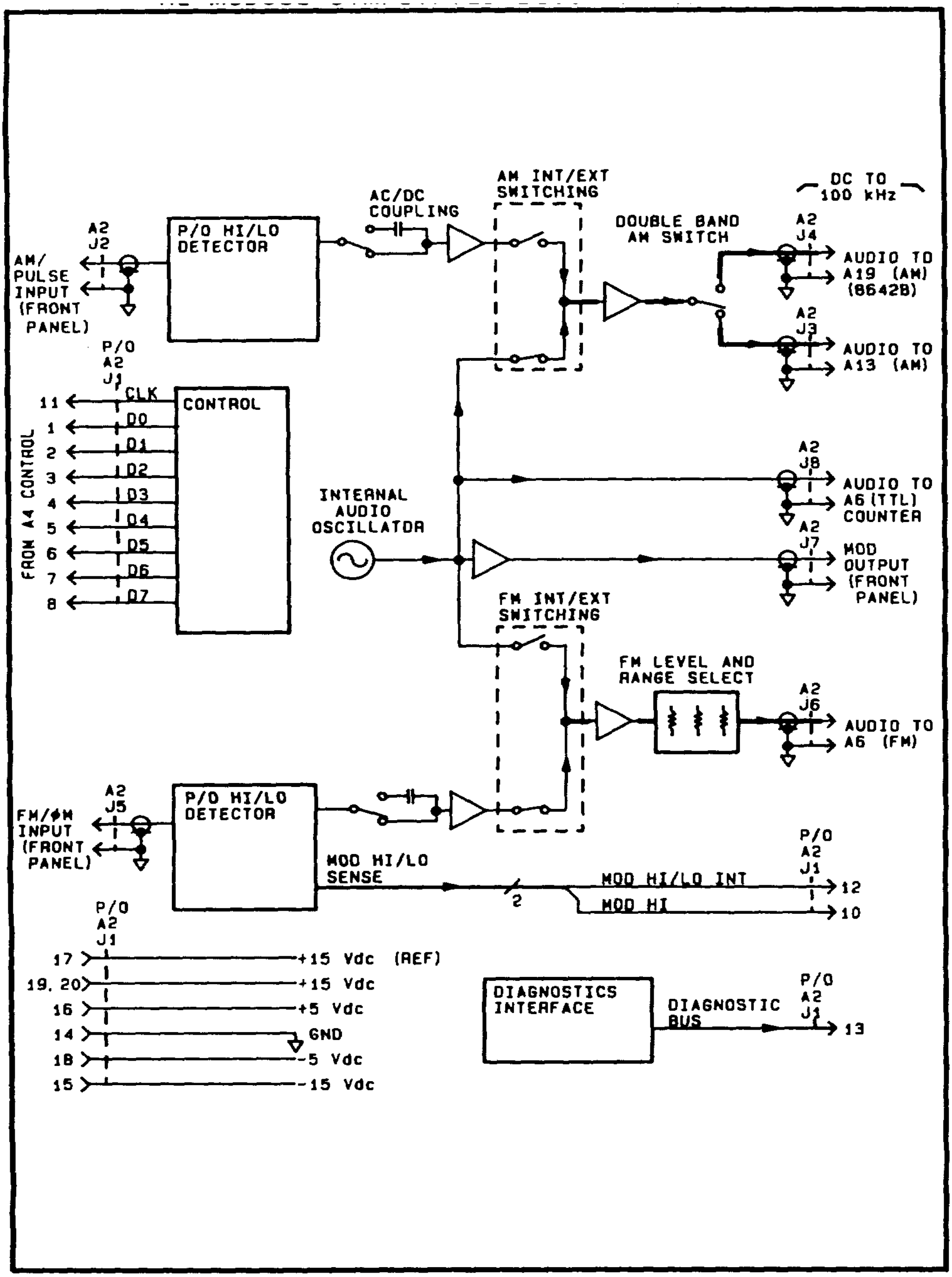
The **A2 Module** generates an audio signal from **10 Hz** to **100 kHz**. This signal is provided to the **A6 FM Loop** frequency and phase modulation and to the **A13 Output Loop** for amplitude modulation. In the **HP** 8642 this signal is sent to the **A19 Doubler** for amplitude modulation in the Doubler Band **(1057.5** to **2115 MHz)**.

The output of **A2's Internal Audio Oscillator** is also sent to the **A6 Counter**. The frequency count generated by the counter is passed to the **A3 Processor**. The Processor compares the frequency count with the specified setting for the audio oscillator and fine tunes the oscillator until the frequency count matches the specified frequency setting.

The **A2 Module** accepts **external** modulation signals via the **"AM INPUT"** and **"FM/IM"** input ports.

See the **A2 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of the **A2 Module's** internal operation.

## A2 MODULE SIMPLIFIED BLOCK DIAGRAM



## A6 THEORY OF OPERATION

### 2-3. A6 FM/COUNTER/TIMEBASE MODULE

**A6 FM LOOP**

The **A6 FM Loop** is the angle modulation source for the instrument. A **135 MHz** voltage controlled oscillator (VCO), phase locked to the timebase, call be either frequency or phase modulated by the audio signal sent from the **A2 Module**.

For **DCFM** operation, the VCO tune path is switched to a stable DC voltage source within the **A6 Module**.

The A6 **FM LOOP OUTPUT** is the reference signal for the **A11 Module**.

**A6 TIMEBASE**

The **A6 Timebase** provides the timebase reference for the instrument. In noimal operation, the various timebase signals required for operation are derived from a free running **45 MHz** oscillator.

For improved stability, the **45 MHz** oscillator can be phase locked to an external source **(1. 2, 5,** or **10 MHz)**

**A6 COUNTER**

The **A6 Counter** counts audio frequencies produced by the internal modulation source in the **A2 Module.** The counter output is sent to the instrument's **Control Section** which provides the tune control for A2's audio oscillator.

Audio frequencies **greater** than 10 kHz are counted directly.

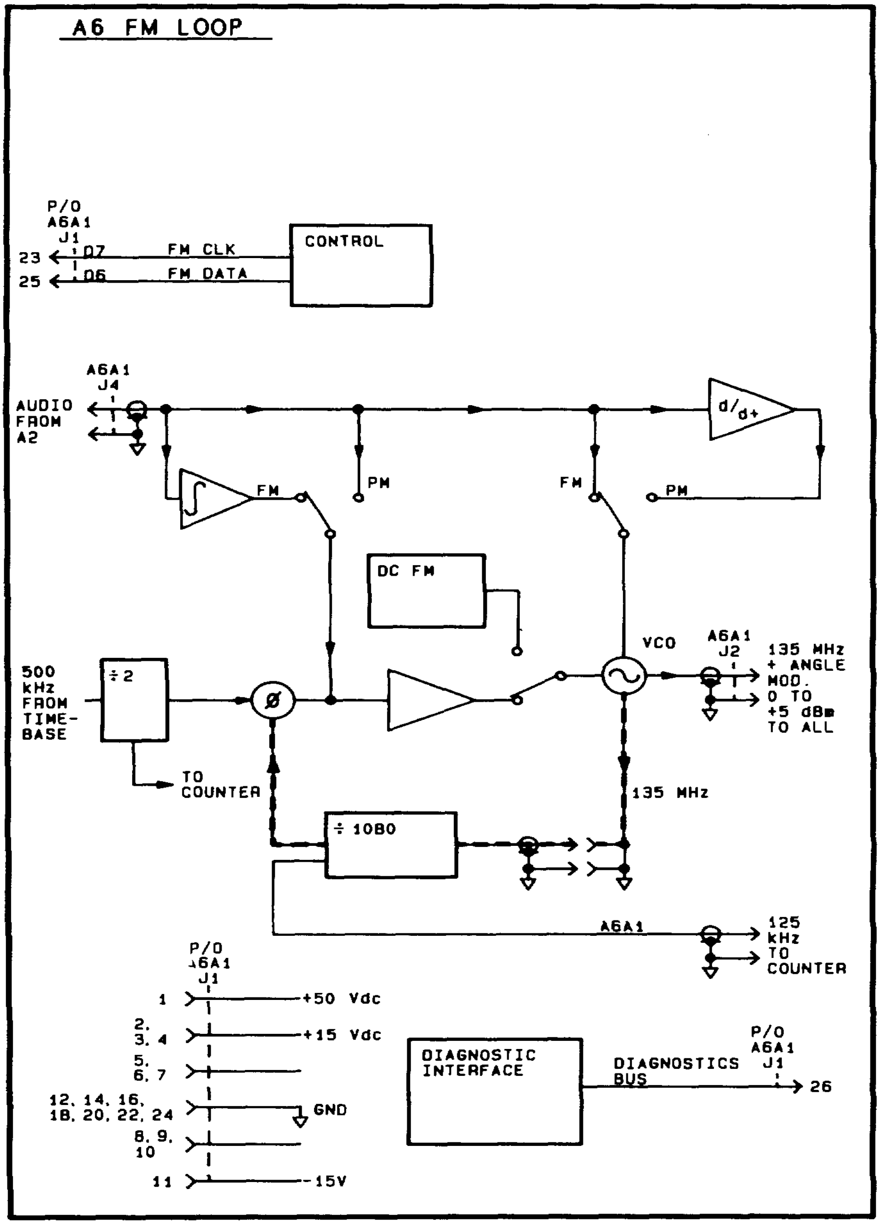
The Timebase output signal is divided and used as the gate clock.

Audio frequencies **below** 10 kHz are counted indirectly. The audio signal is used as the gate clock to count the 45 MHz timebase signal.

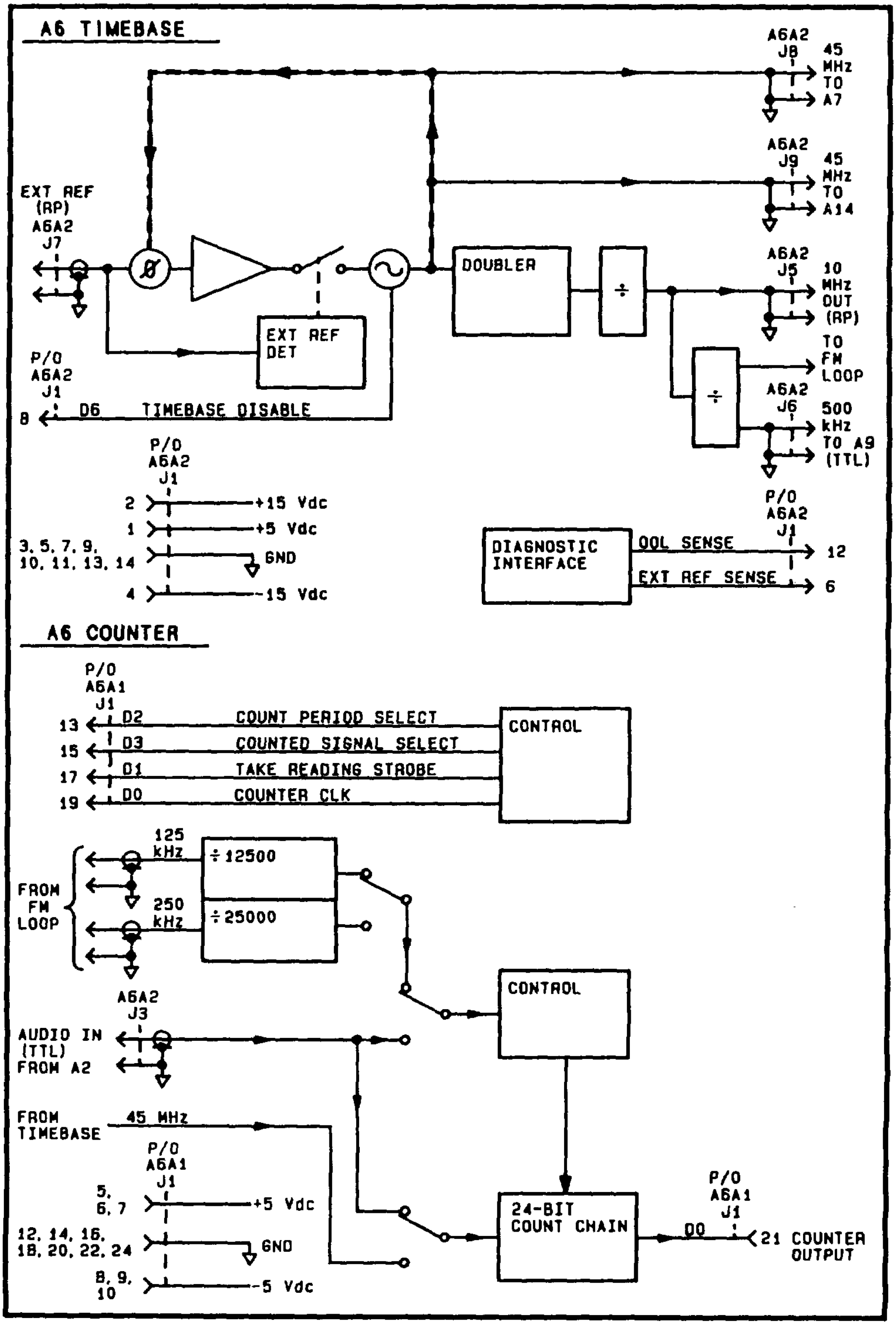
The counter also counts the frequency of the FM Loop, when it is in **DCFM** mode.

See the **A6 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of the **A6 Module's** internal operation.

## A6 MODULE SIMPLIFIED BLOCK DIAGRAM



## A6 MODULE SIMPLIFIED BLOCK DIAGRAM



## A7 THEORY OF OPERATION

### 2-4. A7 SAWR LOOP MODULE

**NOTE**

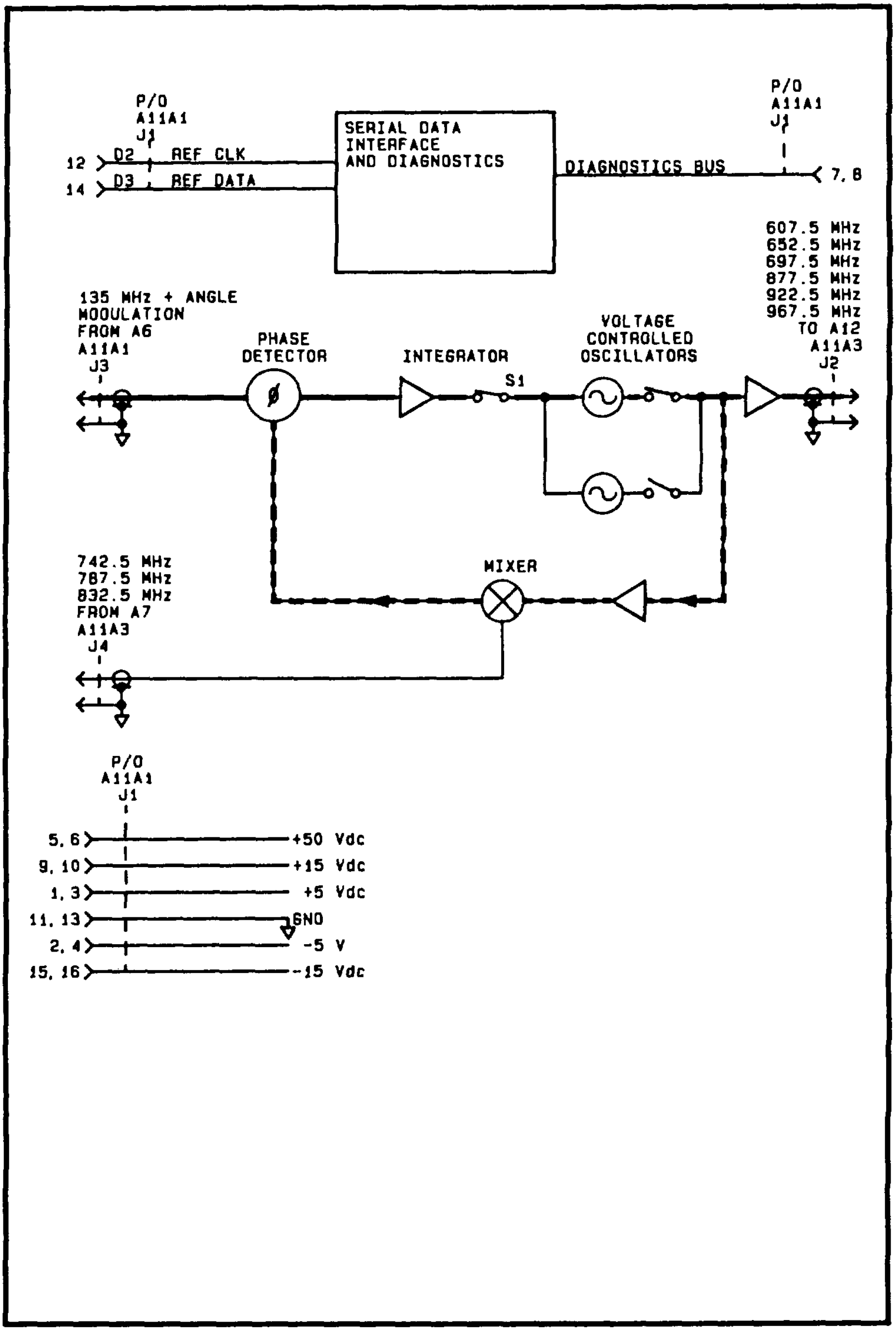
**It is not to essential to understand the internal operation of a module to make an on -site repair.**

The **A7 Module** contains a phase locked loop circuit. Oscillator select lines **A** and **B** are decoded to select one of three Surface Acoustic Wave Resonator (SAWR) oscillators. The oscillators are referenced to the **A6** Timebase output **(45 MHz)**.

The **A7 Module** output: **742.5, 787.5**, and **832.5 Mhz**, is the UHF reference for the **A11 Reference Loop Module**.

See the **A7 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of the **A7 Module's** internal operation.

## A7 MODULE SIMPLIFIED BLOCK DIAGRAM



## 2-5. A9 IF LOOP MODULE

**NOTE**

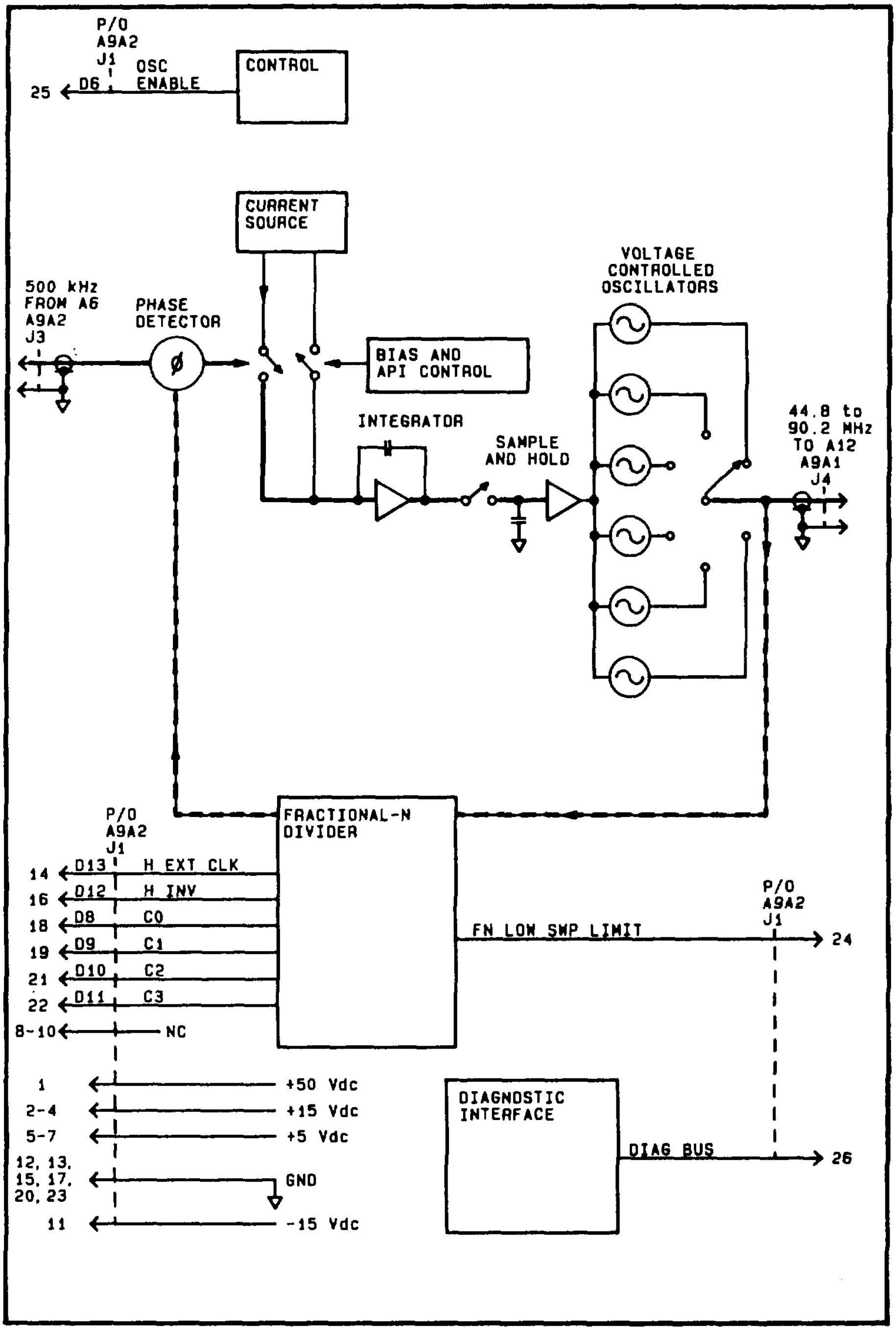
**It is not to essential to understand the internal operation of a module to make an on-site repair.**

The **A9 Module** contains a phase locked loop which is referenced to the **A6 Module** timebase output **(500 kHz).** A fractional-N divider in the loop's feedback path and compensating circuitry in the oscillator tune path allow frequency steps of .05 Hz at the output.

The fractional-N control signals are decoded to select one of six voltage controlled oscillators to produce the output frequency range of **45** to **90 MHz**. The **A9 Module** output provides the reference signal for the **A12 Module**.

See the **A9 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of the **A9 Module's** internal operation.

## A9 MODULE SIMPLIFIED BLOCK DIAGRAM



## 2-6. A11 REFERENCE LOOP MODULE

**NOTE**

**It is not to essential to understand the internal operation of a module to make an on-site repair.**

The **A11 Module** contains a phase lock loop which combines the A6 FM Loop output signal (the angle modulation source of the instrument) with the **A7 SAWR Loop** output (one of three **UHF** reference frequencies) to produce six UHF reference frequencies.

The output of the **A11 Module** is divided into two bands. Each band is generated by a separate voltage controlled oscillator (VCO).

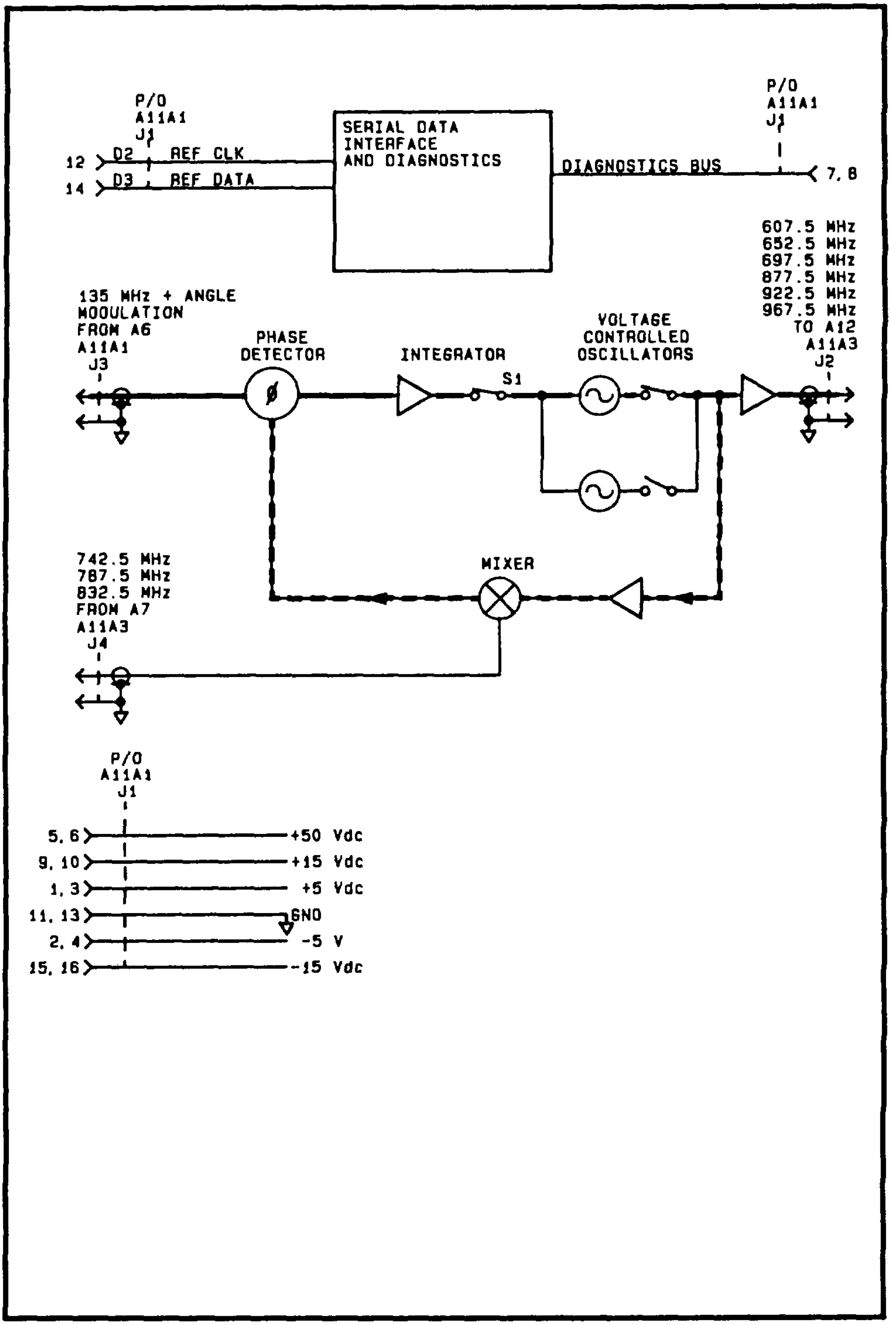
Each of the three upper band frequencies is equal to the sum of the **A6 Module** output signal (135 MHz, plus FM or PM) and one of the three **A7 Module** output frequencies (742.5, 787.5 or 822.5 MHz).

The three lower band frequencies are equal to the difference between the **A6** and **A7 Modules** output frequencies; i.e., 607.5 = 742.5 135.

The **A11 Module** output is the UHF reference for the **A12 Sum Loop/Divider Module**.

See the **A11 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of **the A11 Modules** internal operation.

## A11 MODULE SIMPLIFIED BLOCK DIAGRAM



## 2-7. A12 SUM LOOP/DIVIDER MODULE

**NOTE**

**It is not essential to understand the internal operation of a module to make an on-site repair**

### Sum Loop

The A12 Module contains a phase lock loop which combines the **A9 IF Loop** output **(45** to **90 MHz** in **.5 Hz** steps) with the **A11 Reference Loop** output (one of six **UHF** reference frequencies) to produce the fundamental frequency band of the instrument (**528.75** to **1057.5 MHz**).

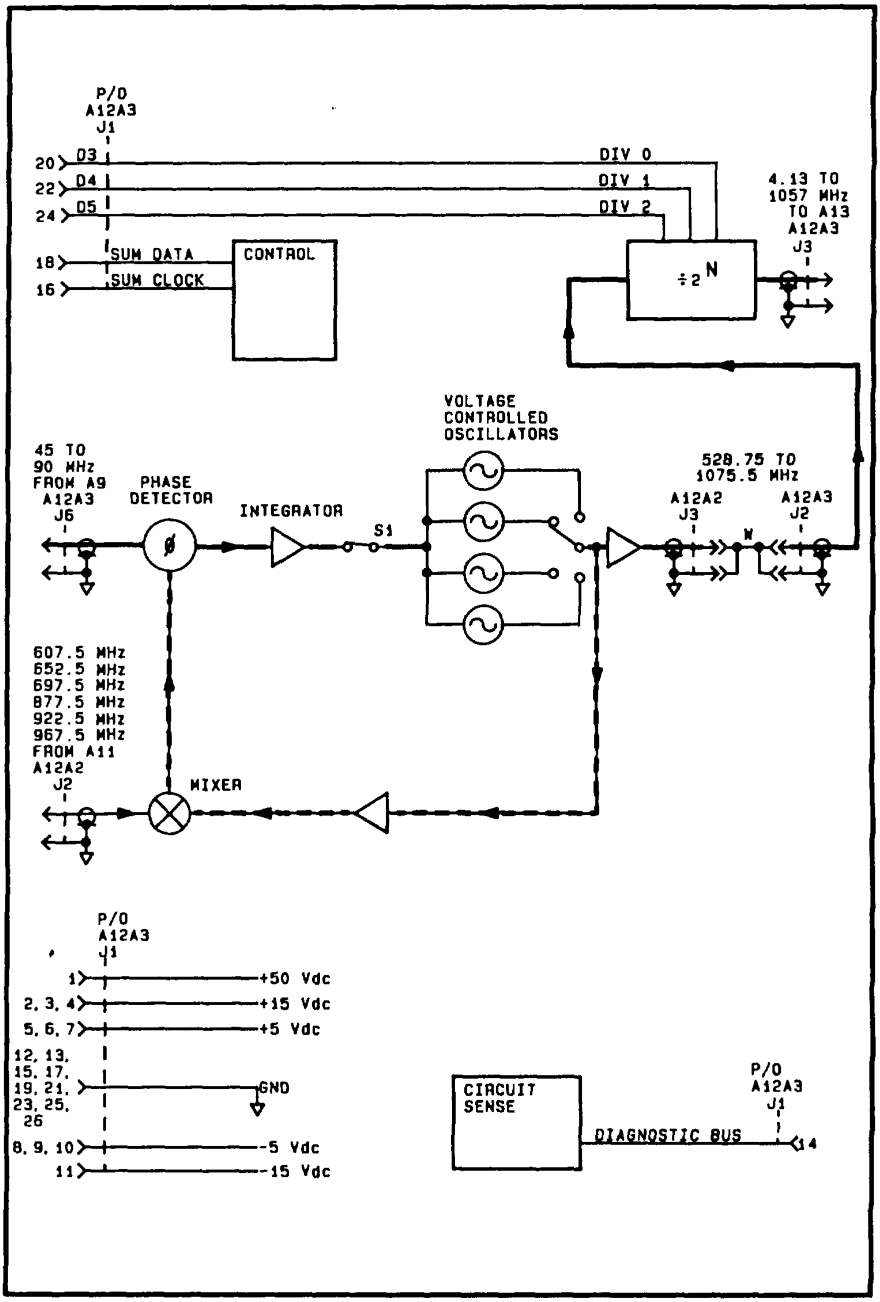
The frequency range of the **Sum Loop** is divided into four bands. Each band is generated by a separate voltage controlled oscillator (VCO).

### Divider

The **A12 Module** also contains a selectable divider circuit. The **Sum Loop** output passes directly to the RF input of the **Divider.** The **Divider** output (**4.1** to **1057.5 MHz**) is produced by dividing the fundamental frequency band by **2** raised the $N^{th}$ power, where N is an integer between **0** and **7**.

See the **A12 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of the **A12 Module's** internal operation.

## A12 MODULE SIMPLIFIED BLOCK DIAGRAM



## 2-8. A13 OUTPUT FILTERS/ALC MODULE

**NOTE**

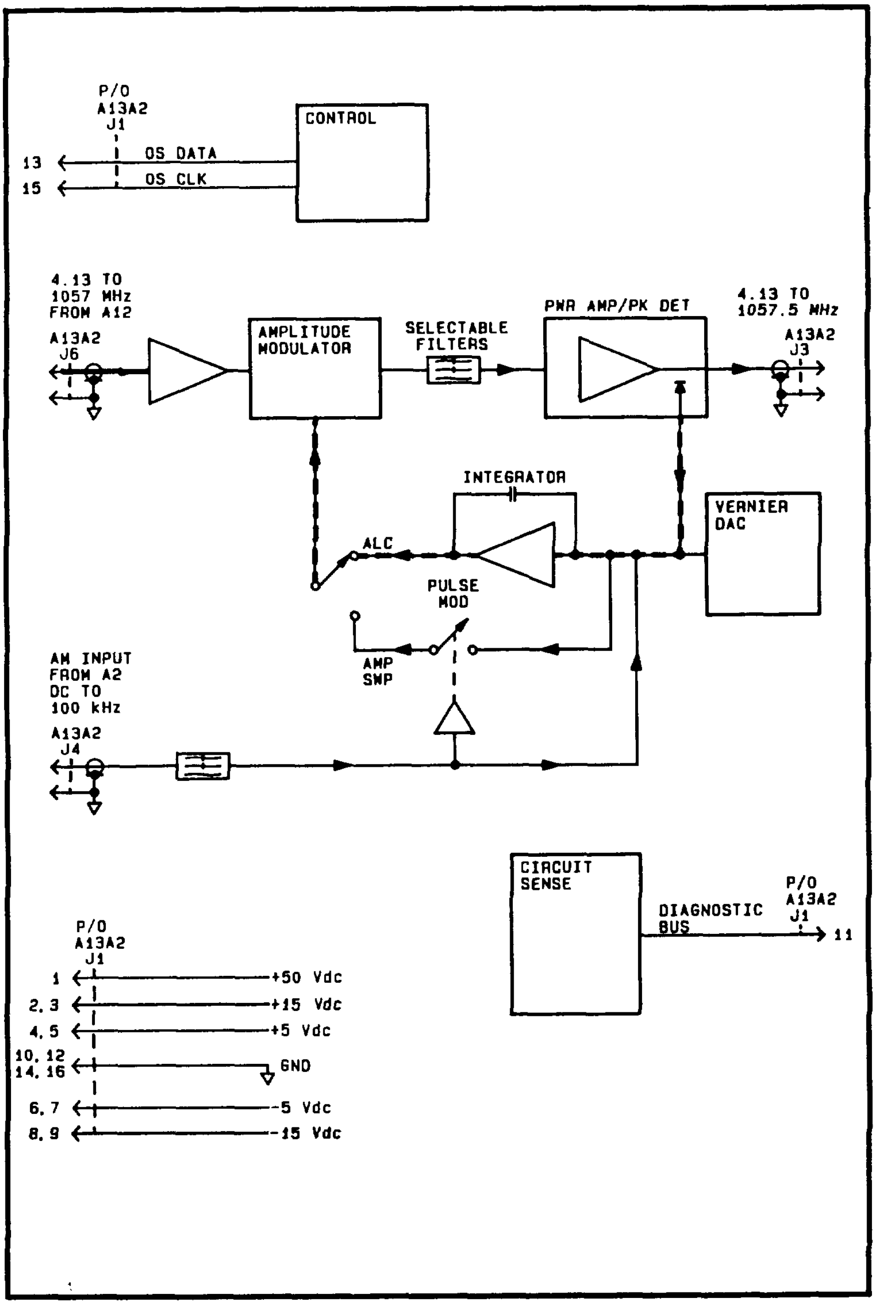
**It is not to essential to understand the internal operation of a module to make an on-site repair.**

The **A13 Module** contains an **Automatic Level Control (ALC)** circuit. The **ALC** loop adjusts the level of the RF signal to between **+5** and **+21.5 dBm** in **0.1 dB** steps. An audio signal, sent from the **A2 Module** is applied to the **ALC** loop's feedback path to provide amplitude and pulse modulation for all output, frequency bands, (except the Doubler Band in the HP 8642B.)

An array of selectable, low-pass filters in the **RF** signal path filters the harmonics produced by the divider in the **A12 Module**.

See the **A13 MODULE SIMPIIFIED BLOCK DIAGRAM** for further understanding of the A13 Module's internal operation.

# A13 MODULE SIMPLIFIED BLOCK DIAGRAM



# A14 HETERODYNE MODULE THEORY OF OPERATION

## 2-9. A14 HETERODYNE MODULE

**NOTE**

**It is not essential to understand the internal operation of a module to make an on-site repair.**

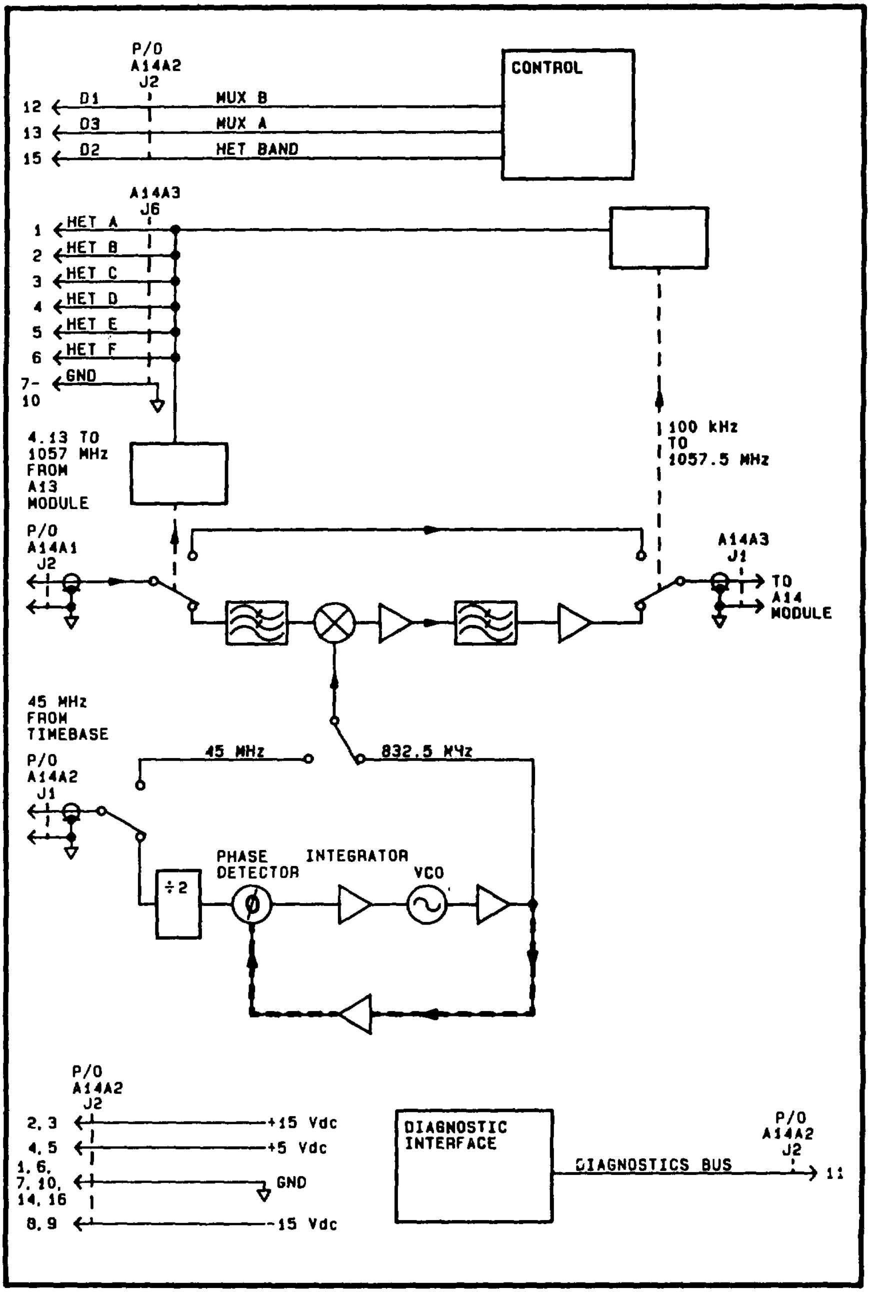
The **A14 Module** switches the **RF** Signal sent from the **A13 Module**, between a through path and the heterodyne path. The heterodyne path down converts the main band signal by mixing it with either **45 MHz** or **832.5 MHz** to produce the two heterodyne bands. Together these two bands provide the output frequency range **100 kHz** to **4.12 MHz**.

The **45 MHz** signal is a **timebase** output sent from the **A6 Module**. The **832.5 MHz** signal is generated by a voltage controlled oscillator within **A14** which is phase locked to the **45 MHz** timebase signal.

The **Switch Drive**, for controlling the path selection switches, is provided by the **A17 Module** in the Power Supply Section.

See the **A14 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of the **A14 Module's** internal operation.

# A14 MODULE SIMPLIFIED BLOCK DIAGRAM



## 2-10. A17 REGULATORS/ATTENUATOR DRIVERS MODULE A18 RECTIFIER/FILTER MODULE

### Power Supply

The **HP** 8642 requires five regulated power supplies for operation: **+50, +15, +5, -5,** and **-15 Vdc**. The **A18 Module** fullwave rectifies the outputs from the Power Transformer **T1**. Each supply line is low-pass filtered and fused on the **A18 Module**. The **+15** and **-15** volt lines are switched open when the (POWER) key on the Front Panel is switched to the **Standby** position. The rectifiers and filters remain active whenever line power is connected to the instrument.

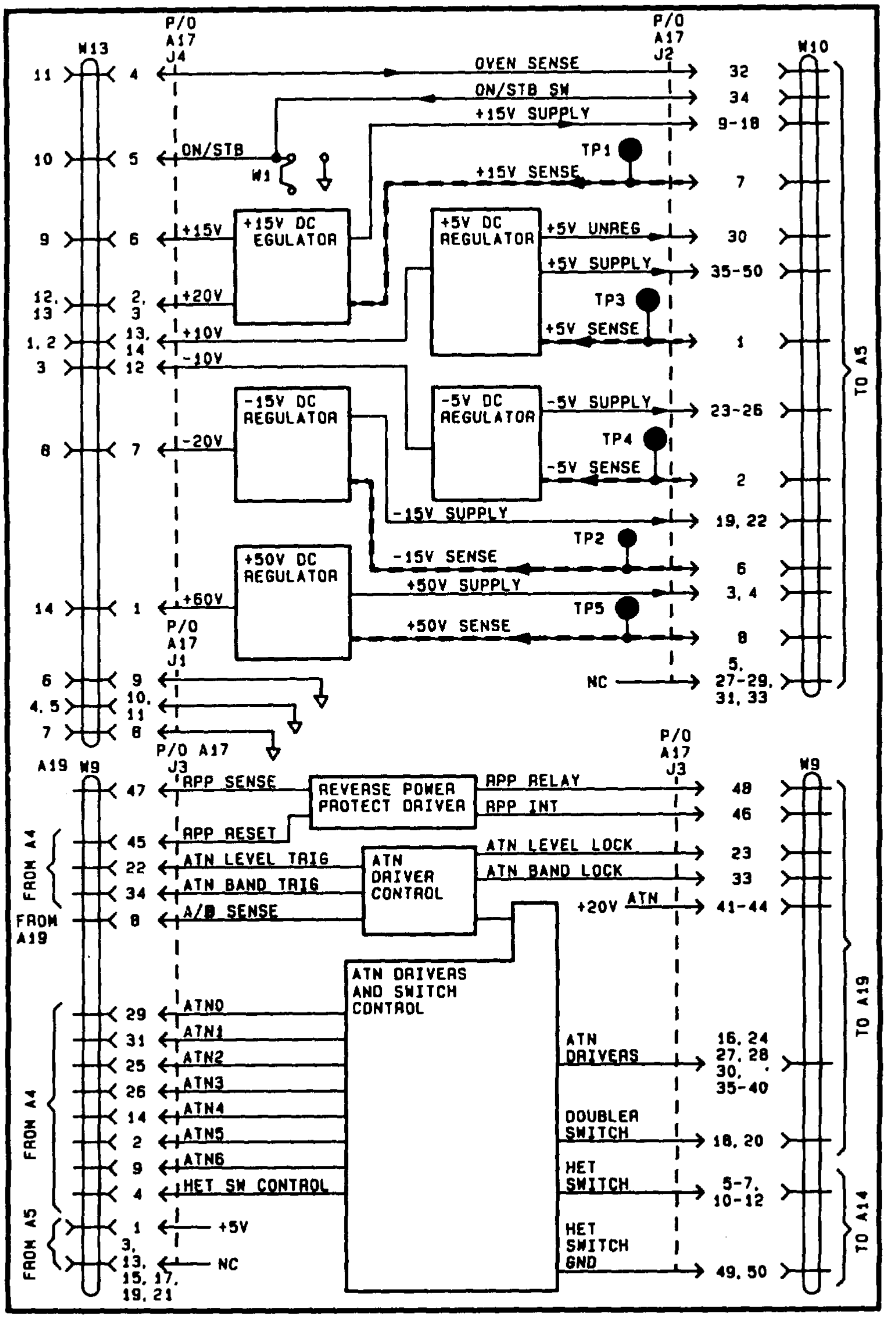
Series-pass type regulators on the **A17 Module** provide level regulation for each supply line. Bias and reference voltages for each regulator are provided by the **+15** and **-15** volt supplies. The output level of each regulator is sensed on the **A5 Assembly** and fedback to control the series-pass element. This requires the supply signal to be present on the **A5 Distribution Assembly** for the regulator to operate. Each regulator is provided with overvoltage protection at its output.

### A17 Drivers

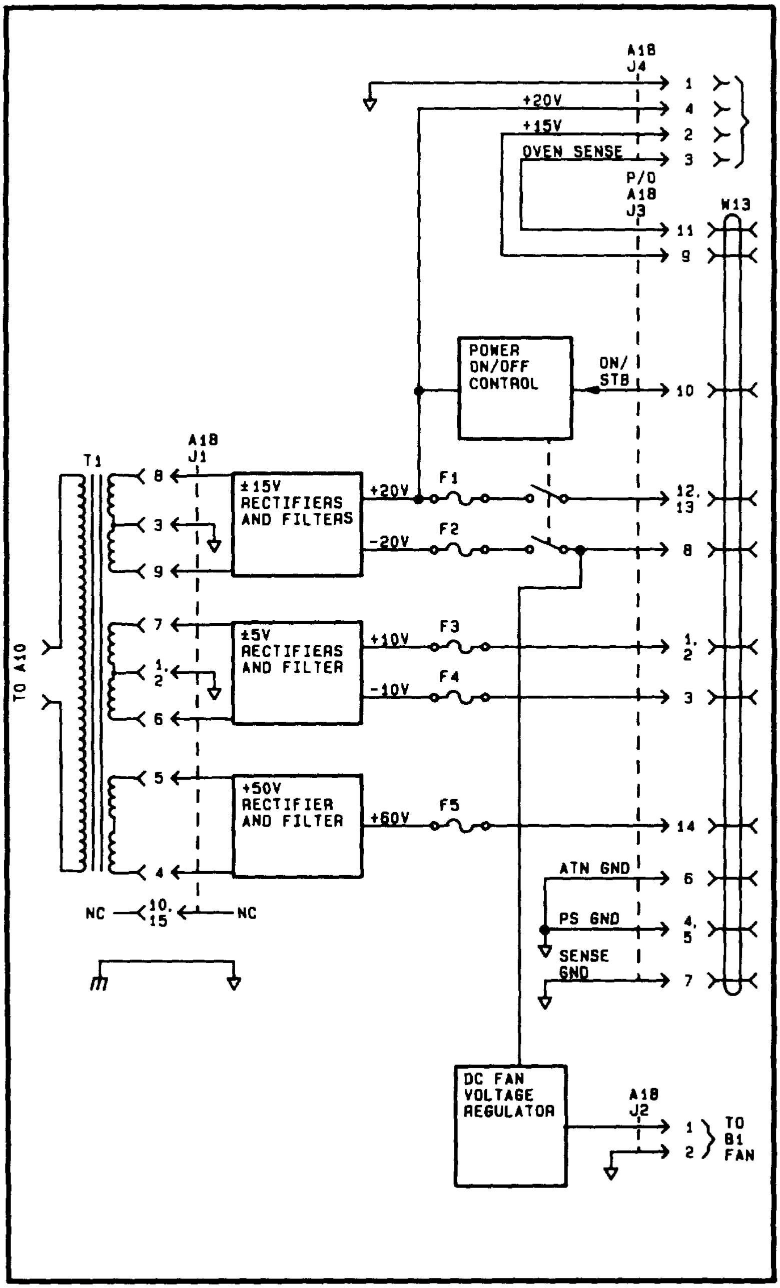
The drivers portion of the **A17 Module** provides the proper drive signals to control the attenuators and **RF** switches in the instrument. It also drives the relay for the reverse power protection circuit. The **A17 Module** senses which attenuator module it is driving and provides pulsed, drive signals to the **A19** modules.

See the **A17** and **A18 MODULES SIMPLIFIED BLOCK DIAGRAMS** for further understanding of the internal operation of these modules.

## A17 MODULE SIMPLIFIED BLOCK DIAGRAM



## A18 MODULE SIMPLIFIED BLOCK DIAGRAM



## 2-11. A19 DOUBLER MODULE

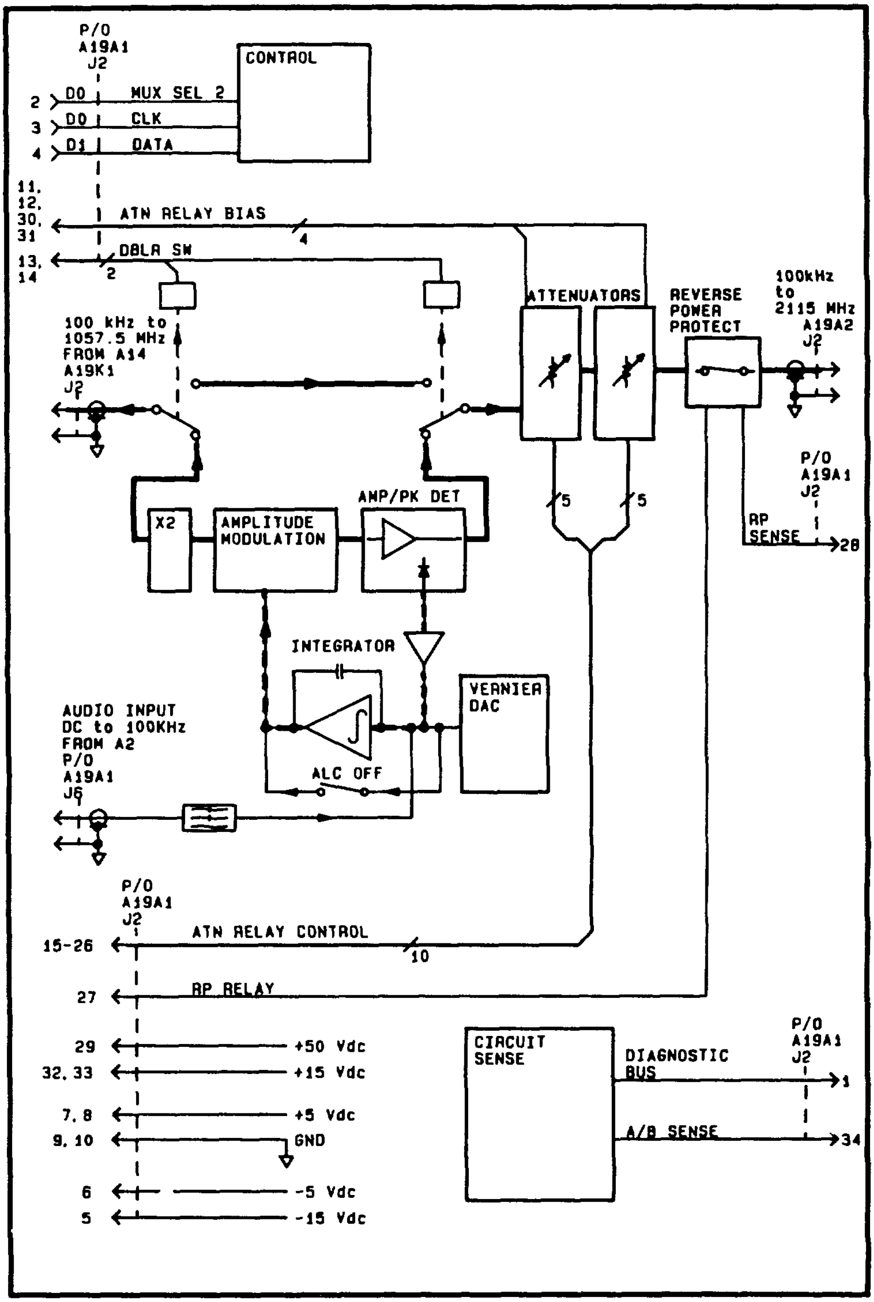
This module provides both frequency doubling and level attenuation for the **RF** output signal. Two attenuator assemblies connected in series provide level attenuation to **-140 dBm**. The second attenuator assembly includes reverse power protection circuitry for the **RF Output** port. The RF switch, attenuator and reverse power control signals are sent to the **A19 Module** from the **A17 Module** in the **Power Supply Section**.

The RF Signal from the **A14 Module** is switched between a through path (for output frequencies from **100 kHz** to **1057 MHz)** and a frequency doubler path. In the doubler frequency band (**1058** to **2115 MHz**) the **RF** signal is amplitude modulated by the **A19 Module** using the audio signal sent from the **A2 Modulation Module**.

The RF output signal from the **A19 Module** is routed directly to the **HP 8642B's RF Output** port.

See the **A19 MODULE SIMPLIFIED BLOCK DIAGRAM** for further understanding of the **A19 Module's** internal operation.

# A19 MODULE SIMPLIFIED BLOCK DIAGRAM



# SECTION III. DIAGNOSTICS

## 3-1. INTRODUCTION.

This Section contains information required for a qualified service technician or engineer to perform module level repair on the HP 8642 Synthesized Signal Generator. The HP 8642 Synthesized Signal Generator will generally be referred to as "HP 8642" or "instrument" in this manual.

## 3-2. ON-SITE SERVICE STRATEGY.

The strategy for on-site service of the HP 8642 is to provide an instrument and support plan which will enable a trained service person to successfully repair at least 80% of the field failures within 2 hours of beginning service on-site. (Repair times may be longer for those with no prior training or experience on the HP 8642.)

## 3-3. HP 8642 SERVICE DESIGN.

The following paragraphs describe the instrument's service features that will enable you to make an on-site repair.

**Modular Design**. Each major electrical function in the instrument is contained within a single module. On-site troubleshooting is to the module level using techniques similar to those used for troubleshooting a system of individual instruments.

**Figure 3-100, RF Section Signal Flow Diagram**, shown on the first foldout in this section, shows all the modules contained in the RF section and each signal path that connects hem. (Note the absence of any feedback paths between the modules.)

The physical location of each module within the instrument is shown by a Top View Diagram located on the inside top cover of the instrument. Color is used in the Top View Diagram and in this manual to designate the three sections of the instrument: Blue - RF (analog) Section; green - Control Section; and red - Power Supply Section.

**Accessible Signals**. A single distribution assembly uses ribbon cable connections located on the tops of the modules to pass all signals from the Power Supply Section and Control Section to the RF Modules. Most signal path checks required for on-site service of the HP 8642 can be made with only the top cover removed.

**Built-in Test Capability**. The instrument has both a DC Voltmeter and an RF Power Meter built into it.

Instructions for using the internal voltmeter and power meter are as follows.

To activate internal voltmeter, connect point to be measured to A4TP1 and press the following push buttons [SHIFT] [SPCL] [3] [2] [5] [HZ]

To repeat voltage measurement, press [5] [HZ]

To activate internal power meter, connect yellow cable to desired measurement point and press the following push buttons [SHIFT] [SPCL] [3] [2] [4] [HZ]

To repeat power measurement, press [4] [HZ]

The measurement parameters for the voltmeter and power meter when used in their manual modes of operation are as follows:

| | |
|---|---|
| Voltmeter | -55 to +55Vdc, ±.5%. |
| Power Meter | -10 to 0dBm, ±5dB. |
| | 0 to +10dB, +3dB. |
| | +10 to +20dBm, +2dB. |

Due to the relatively low accuracy of the built-in voltmeter and power meter, both are primarily used to establish the presence of desired signals rather than their absolute accuracy.

**Internal Diagnostics**. The HP 8642 can provide extensive critical data about its own operating condition. This data is provided in the form of alphanumerically coded service messages. (The service messages can be displayed on the front panel or output to a printer via HP-IB.) The instrument's overall operating condition, as well as the operating condition of individual modules, can be checked using the self-diagnostic routines contained in the firmware of the HP 8642. The following internal diagnostics provide both fault detection and fault isolation for the HP 8642.

**Automatic Fault Detection**

The following Diagnostics provide automatic fault detection for the instrument.

**Power-Up Self Check**. This test sequence runs automatically each time the instrument is powered up and provides a functional check of the instrument's overall operation.

**Fault Detection**. During normal operation, critical sense points within the instrument alert the internal controller when a malfunction occurs. The controller reacts by queuing up the appropriate error message(s) in the instrument's message buffer. The controller will cause the entire front panel display to blink until the malfunction is repaired and the message buffer has been cleared.

**User Initiated Diagnostics** The following diagnostics provide fault isolation capability for the instrument.

**Instrument Level Self Test**. This test sequence is designed to provide an extensive check of the instrument's overall operating condition. The objective of this diagnostic is to identify the module of highest probable cause. (The test sequence begins with a test of the Control Section to verify its ability to test the rest of the instrument.)

**Module Level Diagnostics**. These individual tests allow you to check the operation of any module in the instrument. The objective of these tests is to isolate the malfunction to circuitry within a suspect module or to external circuitry on which the module depends for its operation.

**On-Site Service Kit**

All test equipment referenced out of the On-Site Service Kit is found in paragraph 0-10, Tools and Test Equipment. All repair parts referenced out of the On-Site Service Kit are found in the repair parts book. An A20 Calibration Module (carrying calibration data stored on EEPROM's) for each module that requires calibration data for its operation is supplied with each replacement module.

**NOTE**

**Loading the calibration data provided with a replacement module, into the Control Section of the instrument, enables the replacement module to meet all of its calibrated performance standards without requiring any manual circuit adjustments or additional equipment.**

## 3-4. ON-SITE SERVICE OVERVIEW.

The following outline provides an overview of the On-Site troubleshooting process.

**1. INSTRUMENT LEVEL DIAGNOSTICS**

- Begin troubleshooting to identify module of highest probable cause.

**2. MODULE LEVEL DIAGNOSTICS**

- Test suspect module to isolate detected failure to the module itself or to another module on which the suspect module depends for its operation.

**3. REPLACING A MODULE**

- Install Module
- Down-load calibration data
- Verify repair

## 3-5. INTRODUCTION TO ON-SITE TROUBLESHOOTING.

**Instrument Level Diagnostics**

1. Proceed to paragraph 3-Al, Instrument Level Diagnostics.
2. Pull out the foldout at the back of the **Instrument Level Diagnostics** section and locate the Task Sequence Diagrams shown under **INSTRUMENT LEVEL DIAGNOSTICS**. These diagrams guide you through the process of determining the appropriate module to troubleshoot first.

3. Also, find the **MODULE TROUBLESHOOTING ORDER** chart on the foldout. This chart lists all the modules in the instrument in the order in which they should be tested.

**NOTE**

**The troubleshooting order is based on signal dependency between the modules as shown in Figure 3-100 (on the first foldout) in this section. Determining the correct module to troubleshoot first is necessary since a defect in one module will often cause subsequent modules to indicate malfunctions as well.**

4. Fold the **Instrument Level Diagnostics** foldout back into the manual.

**Module Level Diagnostics**

1. Find the area in the **Diagnostics** section for **"A13"**. (All the module level tests for the **A13 Module** are contained in this section.)
2. Pull out the foldout at the back of the **A13** section.
3. Find **A13 MODULE SUBSTITUTION** on the foldout. The Task Sequence Diagram shown in this block guides you through the process of testing the operation of the suspect module by substituting a known good module, from the On-site Service Kit, into the circuit.

**NOTE**

**In most cases, the module substitution test only requires connecting input and output cables to the known good module without installing it in the instrument.**

4. Find **A13 INPUTS VERIFICATION** on the foldout. If the same failure conditions were indicated with a known good module substituted into the circuit (or if a known good module was not available), the next step is to check each input to the module. These Task Sequence Diagrams guide you through the process of checking each RF, control and power supply input signal to the A13 Module.

5. Find the **A13 MODULE CABLE CONNECTIONS LOCATOR** on the foldout. This is a top view diagram of the HP 8642 that shows A13's location in the instrument and the location of each cable connection on A13 which is involved in on-site repair.

6. Find the **A13 MODULE I/O SIGNALS DIAGRAM** shown on the right of the foldout. This provides a system overview of all parts on which the A13 Module directly depends for its operation.

7. The procedures for completing each task shown in the Task Sequence Diagrams are provided on the text pages immediately preceding the foldout. Find the procedure listed for **A13.12**


This test is designed to check the voltage level on each power supply input to the **A13 Module**.
8. Familiarize yourself with the test now by reading the first sentence or phrase after each step number. The instructions are formatted so that scanning the procedures in this way will give you a preview of the test (previewing each test will help you to perform the test procedure quickly and accurately).
9. Fold the **A13 Module** foldout back into the manual.
10. Pull out the foldout at the end of the **A12 Module** section. The Task Sequence Diagrams on this foldout provide an example of how the process model is modified when necessary to provide the best test strategy for each module. Here (and also on the All Module), the inputs are checked first because of an added risk factor involved in the A12 Module substitution technique.
11. Find the Task Sequence Diagram entitled **1.A12 RF INPUT CHECK** on the foldout. Note the Result Blocks that indicate specific error codes for determining which task to perform next. (The slash S (/S), placed at the end of the word "ERROR/S" in these Result Blocks, implies that the test path should be taken if you observe any one or more of the error codes in the given range.
12. Fold the **A12 Module** foldout back into the manual.

**Exceptional Cases**

Due to limitations of the diagnostic routines and the built-in test equipment, the test procedures contained in this manual are not able to isolate all possible failures in the instrument. The last portion of the **DIAGNOSTICS** section, **Exceptional Cases**, contains help for troubleshooting many of these failures.

## 3-6. TO BEGIN TROUBLESHOOTING THE HP 8642.

**Identify Failure Condition**

Condition 1. Instrument does not power-up to an operational condition.
Condition 2. Failure does not cause instrument to generate any error message.
Condition 3. Failure does cause instrument to generate an error message, but failure occurs intermittently.
Condition 4. Failure does cause instrument to generate an error message, but failure does not appear to be intermittent.

**Repair Recommendations for Condition 1**
If the instrument does not power-up to an operating condition, follow the procedures provided for Instrument Level Diagnostics (Condition 4) to begin isolating this problem.

**Repair Recommendations for Condition 2**
Many failure conditions which are not detected by the HP 8642 during its normal operation can be detected by the diagnostic procedures provided in this manual. (For further information on servicing a failure of this type, refer to the Exceptional Cases section of this manual.)

**Repair Recommendations for Condition 3**
Failures which occur intermittently impede the HP 8642's ability to provide reliable failure data. However, there are certain techniques which, when used in conjunction with the diagnostic routines, permit effective troubleshooting of the instrument. (See the Exceptional Cases portion of the **DIAGNOSTICS** Section which describes the techniques for troubleshooting intermittent failures.)

**Repair Recommendations for Condition 4**
Proceed to paragraph 3-A2 to begin troubleshooting process.

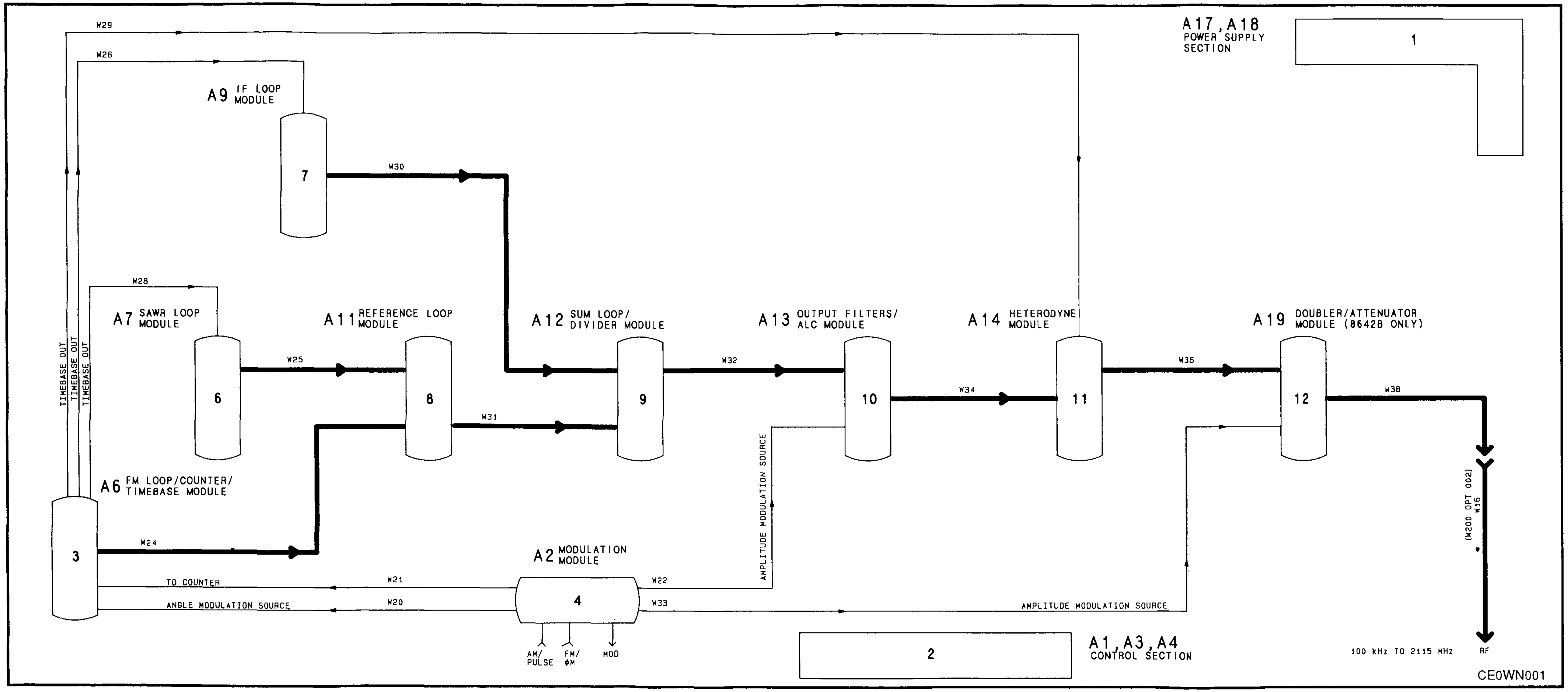



Figure 3-100. RF Section Signal Flow Diagram.

# INSTRUMENT LEVEL DIAGNOSTICS

## 3A-1. INTRODUCTION

**WARNING**

**The HP 8642 is extremely heavy. Do not lift or carry the instrument without assistance.**

**If the instrument is rack mounted, do not pull the instrument from the rack without assistance.**

The **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** are the first level of troubleshooting for the **HP 8642**. The objective of this group of tests is to isolate the source of a detected failure to the correct section of the instrument: **Power Supply, Control** or **RF Section**. The **ILD** should be used to determine the appropriate place in the instrument to begin module level troubleshooting.

**NOTE**

**Testing at this level requires two BNC coax cables not supplied in the On-Site Service Kit.**

Test Instructions

1. **The last page in this group of tests is a foldout and should be pulled out now**.
2. Find **INSTRUMENT LEVEL DIAGNOSTICS** on the foldout.
3. Use the Task Sequence Diagram, shown under **INSTRUMENT LEVEL DIAGNOSTICS** to direct you through the testing process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.
4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.
5. Begin now by performing the first task shown on the diagram.

## INSTRUMENT LEVEL DIAGNOSTICS

| | | |
|---|---|---|
| Type: | Instrument Level Self Test | **IL.01** |
| Run Time: | 6 min 30 sec |  |
| Set-up Time: | 1 min | |



The **Instrument Level Self Test (ILST**) is designed to check the operation of each module in the instrument.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.

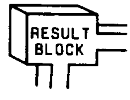
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].

3. When "**WAITING FOR SET-UP 1 .V74**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/fM INPUT"**. (See foldout for setup diagram.)
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT**".
   - [HZ] to continue.
4. When test is complete
   **"DIAG DONE HIT MSSGS .VI"** will appear:
   - Use [MSSG] to scroll through messages.
   - Record each **module number** indicated. (See Front Panel Diagram on foldout to locate **module number** in display message.)

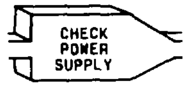
**NOTE**

**If "NO MESSAGES .00" appears: Then all modules have passed the Instrument Level Self Test. (The Instrument Level Self Test indicates test failures only.)**

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST INSTRUMENT**.



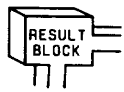
## INSTRUMENT LEVEL DIAGNOSTICS

| | | |
|---|---|---|
| Type: | Supply Lines Check | **IL.02** |
| Run Time: | 2 min |  |
| Set-up Time: | 2 min | |

1. Remove Top Cover. (See table on foldout in **MECHANICAL PROCEDURES** to locate Top Cover removal information.)
2. Connect **external DC** voltmeter ground lead to instrument's chassis.
3. Measure Power Supply output voltage levels on **A17 Module** at test points **TP1 through 5.** (See Top View Diagram on inside of Top Cover for test point locations and voltage levels.) Voltages should be within approximately **1%** of those shown with test points on Top View Diagram.
4. The tuning screws located next to **A17TP1 through 5**, can be used to fine tune voltage levels which are slightly high or low.

**NOTE**

**The voltages measured at A17TP1 through 5 are being fed back from sense points on the A5 Assembly. A correct measurement verifies the presence of the voltage on the A5 Distribution Assembly.**

5. Record the results.
6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 
 for **CHECK POWER SUPPLY.**

## INSTRUMENT LEVEL DIAGNOSTICS

| | | |
|---|---|---|
| Type: | Identify Conditions | **IL.03** |
| Run Time: | N/A |  |
| Set-up Time: | N/A | |

The operating conditions which will cause the **Instrument Level Self Test** to pass are listed below. Find the **condition** which describes your circumstances.

**Condition 1:** **Instrument Level Self Test (ILST)** did not detect a known failure.

**Condition 2:** **Instrument Level Self Test (ILST)** was run to confirm correct operation of instrument.

**<u>Condition 1</u>**

**Output Power Level Failure**: To isolate output power level problems which occur at power levels above **-10dBm** and are greater than **10 dB** out of specification, go to **A14 MODULE LEVEL DIAGNOSTICS (MLD)** section. For output power level problems which occur only at settings below **-10dBm** or are less than **10dB** out of specification, go to **EXCEPTIONAL CASES section**.

**Other Failures**: To isolate failures which can be detected by the internal diagnostics when the **HP 8642** is set to a specific operating condition, go to the **MLD** section for the module indicated by the instrument. If two or more failures are indicated, go to the **MLD** section for the failing module with the **lowest Troubleshooting Order Number** (see **MODULE TROUBLESHOOTING ORDER** on the foldout).

To troubleshoot failures which cannot be detected by the internal diagnostics, go to **EXCEPTIONAL CASES** section.

**Intermittent Failures**: To troubleshoot intermittent failures, turn to **EXCEPTIONAL CASES** section.

**Execution Errors**: Certain incompatible operating conditions will cause service messages to come up. Check for operating modes which do not comply with the **HP 8642's** operating specifications.

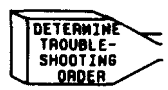
**Condition 2**

**Repair Confirmation: If Instrument Level Self Test** was able to detect failure before repair was made; a passing test now indicates repair has corrected failure. If **ILST** was not able to detect failure prior to repair, check instrument in operating condition which indicated failure.

**Operation Check**: The **ILST** checks **80%** of the instrument's overall operation.

## MODULE TROUBLESHOOTING ORDER

| | | |
|---|---|---|
| Type: | Module Priority | IL.04 |
| Run Time: | N/A | |
| Set-up Time: | N/A | |



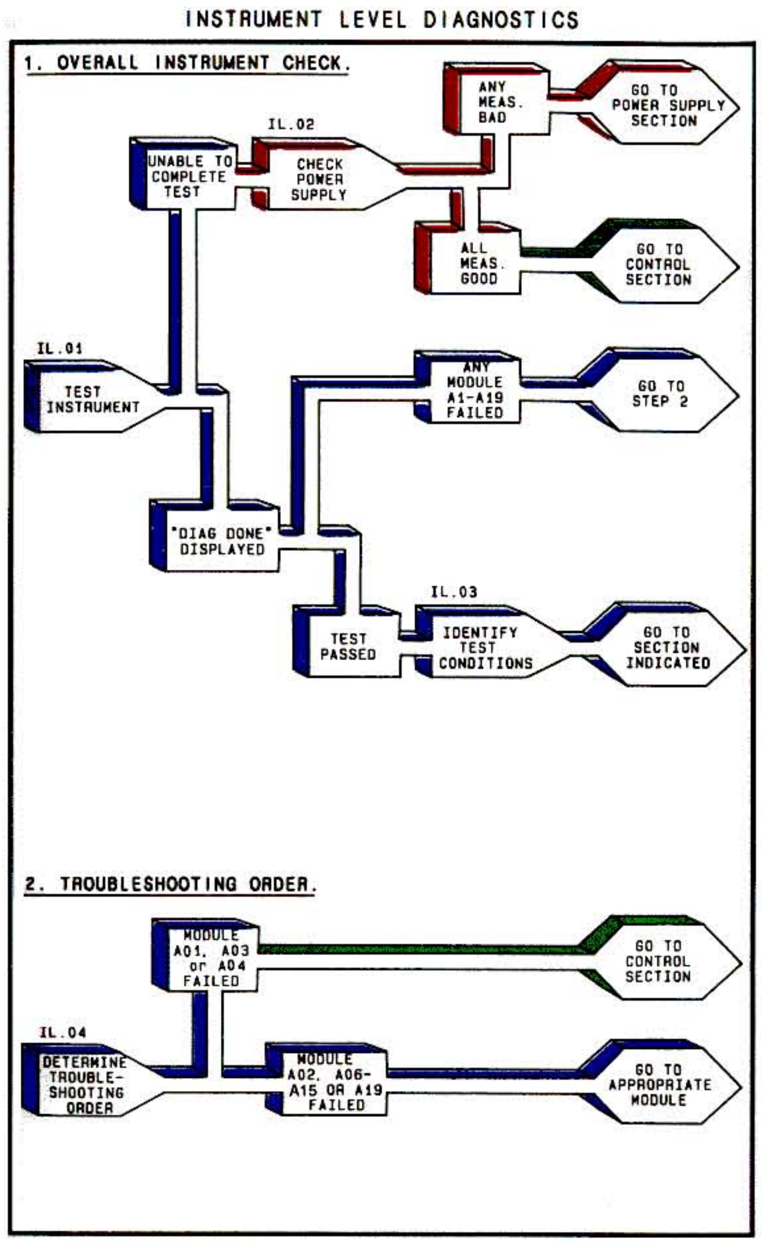

A troubleshooting priority level has been established for each module. **Failing modules must be tested in their order of priority**.

1. Find **MODULE TROUBLESHOOTING ORDER** on foldout. This table lists all HP 8642 modules covered by onsite diagnostics. The modules are listed in the order which you should troubleshoot them.

2. If the **Instrument Level Self Test** has indicated two or more failing modules, use the table to determine which failing module has lowest **Troubleshooting Order number**.

3. Locate the **Module Level Diagnostics** section for the **failing** module with the lowest **Troubleshooting Order Number**.

4. Return to Task Sequence Diagram on foldout.




**MODULE TROUBLESHOOTING ORDER**

| Modules | Troubleshooting Order Number | Instrument Section |
|---|---|---|
| **A17** Power Supply Regulators/ Attenuator Drivers Module | 1 | Power Supply Section |
| **A18** Power Supply Rectifier/ Filters Module | | |
| **A01** Keyboard/LCD Display Module | 2 | Control Section |
| **A03** Processor/Memory Module | | |
| **A04** Latch Module | | |
| **A06** FM Loop/Counter/ Timebase Module | 3 | RF Section |
| **A02** Modulation Module | 4 | |
| | | |
| **A07** SAWR Loop Module | 6 | |
| **A09** IF Loop Module | 7 | |
| **A11** Reference Loop Module | 8 | |
| **A12** Sum Loop/Divider Module | 9 | |
| **A13** Output Filters/ALC Module | 10 | |
| **A14** Heterodyne Module | 11 | |
| | 12 | |
| **A19** Doubler/Attenuator Module | | |

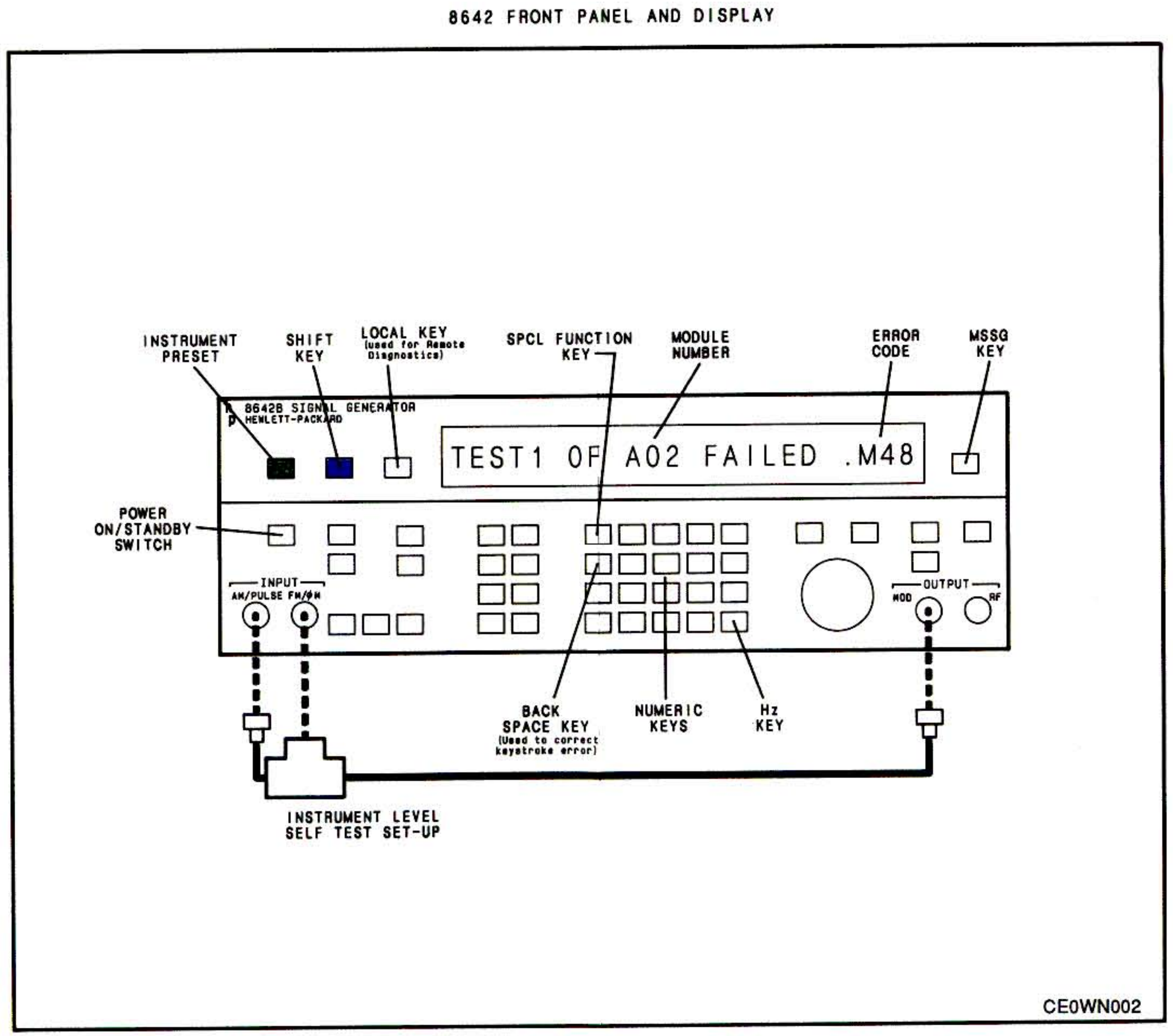



Figure 3A-100. Instrument Level Diagnostics

## POWER SUPPLY SECTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **Power Supply Section** modules: **A17 Power Supply Regulators/Attenuator Drivers Module** and **A18 Power Supply Rectifier/Filter Module**. The objective is to isolate the failure to a module or to a part on which this section depends for operation.

**WARNING**

**Servicing instructions are for use by service trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.**

**Some procedures described in this manual are performed with power supplied to the instrument while protective covers are removed. Energy levels at certain points may, if contacted, cause personal injury.**

**Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.**

**For continued protection against fire hazard, replace the line fuse(s) only with 250v fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.**

**The left rear portion of the chassis becomes hot during operation. A cooling period may be desired before servicing modules in this area. To avoid personal injury, avoid contact with the A17 heatsink.**

### Test Instructions

1. The instrument's **Top Cover** must be removed to run many of these tests. (Refer to the table on the foldout in **MECHANICAL PROCEDURES** to locate instructions.)

## POWER SUPPLY SECTION

2. Testing in this section is divided into two categories: **A17 Module** failures, including **Attenuator Drivers, Heterodyne Switch Control**, and **Reverse Power Protection Control** and **Power Supply** failures.

3. **A17 Module**: If you were directed here because of a drivers failure detected while testing the **A14, A16 or A19** modules, or if the **Instrument Level Self Test** indicated an **A17** failure, turn to page **3B-3** to begin troubleshooting.

4. **Power Supply**: If you are here because of an apparent **Power Supply** failure, turn to the next page to begin troubleshooting.

## 3B-2. INTRODUCTION

The first step in troubleshooting a **Power Supply Section** failure is to isolate the defective module or cable.

**Troubleshooting Instructions**

1. There are two foldouts located at the end of this section. The first foldout, **Figure 3B-100**, is used for troubleshooting **Power Supply** failures and should be pulled out now.

2. Find **POWER SUPPLY DIAGNOSTICS** on the foldout.

3. The Task Sequence Diagrams, shown under **POWER SUPPLY DIAGNOSTICS** are separated into two checks**: 1. A18 RECTIFIERS/FILTERS CHECK** and **2. A17 REGULATORS CHECK.**

4. Use the Task Sequence Diagrams to guide you through the verification process. Each Task Arrow shown in a diagram indicates a task title and a task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

5. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

6. Begin now by performing the first task shown under **1. A18 RECTIFIERS/FILTERS CHECK**.

**NOTE**

**The POWER SUPPLY I/O SIGNALS DIAGRAM shows all parts which these modules depend on for operation.**

## A17 INPUTS VERIFICATION

### 3B-3. INTRODUCTION

The first step in troubleshooting failures indicated for the **Attenuator Drivers, Heterodyne Switch Control** or **Reverse Power Protection Control** portions of the **A17 Module**, is to check each control signal into this module.

**A17 Inputs Verification Instructions**

1. The last page in this section is a foldout, **Figure 3B-200**. It is used for troubleshooting the drivers portion of **A17** and **should be pulled out now**.

2. Find **A17 INPUTS VERIFICATION** on the foldout.

3. Use the Task Sequence Diagrams shown under **A17 INPUTS VERIFICATION** to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task number and task title. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown on the diagram.

**NOTE**

**You will find the A17 MODULE DIAGNOSTICS procedures at the end of this section following the POWER SUPPLY DIAGNOSTICS procedures.**

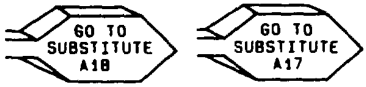
**NOTE**

**The A17 MODULE I/O SIGNALS DIAGRAM shows all parts on which the drivers portion of this module depends for operation.**

## A17 & A18 MODULE SUBSTITUTION

PS.01

### 3B-4. INTRODUCTION




Substitution of a known good module is used to further test a suspect module.

**A17 & A18 Substitution Instructions**

1. Find **A17 & A18 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A17 & A18 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram for the module you have been directed to substitute.

## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| Type: | Voltage Measurements | **PS.02** |
| Run time: | 1 min. |  |
| Set-up time: | 2 min. | |

**External DC** Voltimeter is used to check power supply levels at **A17TP1 through 5**.

**Run Test**

1. Connect instrument's power plug to a known good power source.

2. Switch (POWER) to **ON** (recessed position).

3. Connect **external DC** voltmeter **ground lead** to instrument's chassis.

4. Measure Power Supply output voltage levels on **A17 Module** at test points **TP1 through 5**. (See **A17 & A18 MODULES CABLE CONNECTION LOCATOR** on foldout to locate test points on **A17**.) Voltages should be within approximately **1%** of those shown in chart on foldout.

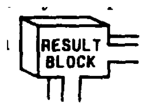
5. The tuning screws located next to **A17TP1 through 5**, can be used to fine tune voltage levels which are **>1%** high or low.

**NOTE**

**The voltages measured at A17TP1 through 5 are being fed back from sense points on the AS Assembly. A correct measurement verifies the presence of the voltage on the AS Distribution Assembly.**

6. Record test results.

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST Vdc**.



## POWER S('PPLY DIAGNOSTICS

| | | |
|---|---|---|
| Type: | Fuse Check | **PS.03** |
| Run time: | 4 |  |
| Set-up time: | 2 min. | |

**External DC** voltmeter is used to test fuses and rectifier output levels.

1. Remove **A18 Module's** Top Cover located in right-rear corner of instrument (one screw).

2. Connect power to instrument and switch [POWER] to **ON** (recessed position).

3. Measure voltage levels
   - Use external DC voltmeter to measure voltage levels, with respect to ground, at fuses **A18F1 through 5**.
   - Leave fuses in instrument and measure voltage levels at both ends of each fuse holder for **F1 through 5**.
   - Voltage levels should be within ranges shown in following chart and should read the same at both ends of each f use.

| Fuse Voltages, Vdc | | | | |
|---|---|---|---|---|
| F1 | F2 | F3 | F4 | F5 |
| +15 to +30 | -30 to -20 | +8 to+13 | -13 to -8 | +60 to +80 |

   - If all fuse holders measured good at both ends, proceed directly to step 5.
   - If any fuse holders measured bad at both ends, proceed directly to step 5, otherwise continue testing.

**CAUTION**

**Disconnect line power to instrument when removing or replacing fuses.**

## POWER SUPPLY DIAGNOSTICS

4. Replace blown fuses:
   - Use plastic Fuse Puller, from On-Site Service Kit, to remove fuses.

**NOTE**

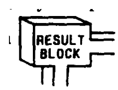
**Use side-notched end of Fuse Puller to hook fuse and pull it from instrument. Use end-notched end of Fuse Puller to place fuses in fuse holders or to pick up fuses dropped into instrument.**

   - Replace blown fuses with a good fuse of proper rating from the On-Site Service Kit. (Fuse ratings are shown on Top View Diagram on inside of instrument's Top Cover at each fuse location.)
   - Reconnect power to instrument, switch (POWER) to **ON** position and repeat procedure beginning at step 3.

5. Record test results.

**NOTE**

**If this test has directed you to replace a blown fuse, and if as a result of changing the fuse all levels now measure good, do not return to the foldout. Instead, return to the INSTRUMENT LEVEL DIAGNOSTICS section and rerun the ILST.**

6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

 for **TEST FUSES**.

## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| Type: | I/O Signals Check | **PS.04** |
| Run time: | 2 min. |  |
| Set-up time: | 1 min. | |

**External DC** voltmeter and ohmmeter are used to check signal levels at **A17J1**.

**Run Test**

1. Disconnect line power to instrument.

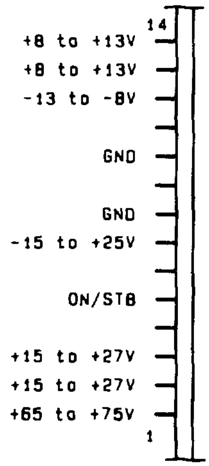
2. Check **Power Switch**:
   - Connect one test lead of **ohmmeter** to **GND (A4TP2)**. (See **A17 & A18 MODULES CABLE CONNECTION LOCATOR** on foldout.)
   - Connect other test lead to Power Switch control line **(A17J1** pin **5)**. (See **A17 & A18 MODULES CABLE CONNECTION LOCATOR** on the foldout to locate **A17J1.**) **Figure 3B-1**. shows signal locations for **A17J1.**
   - Switch (POWER) to **ON** (recessed position). Resistance should measure between **0** and **10** ohms.
   - Switch (POWER ) to **Standby**, resistance should be greater than **500** ohms.
   - If switch line **is not** responding as described above proceed directly to step **6**, otherwise continue testing.
   -

3. Disconnect ohmmeter from **A17J1** and reconnect power to instrument.

4. Switch (POWER) to **ON** position.

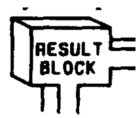
5. Measure voltage levels:
   - Connect voltmeter's ground lead to GND (A4TP2).
   - Measure DC voltages at connector **A17J1** on solder-side of A17 Module. Voltage level ranges and locations are shown in **Figure 3B-1**.

**Figure 3B-1. Connector A17J1 Signal Locator (Solder-Side View)**

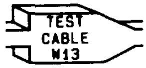



6. Record test results.

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **CHECK A17J1**.



## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Check | **PS.05** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 30 sec. | |



Cable **W13** is tested by checking continuity between cable ends and **A17J1.**

**<u>Run Test</u>**

1. Remove power from instrument and disconnect cable **W13** from **A18 Module** at **A18J3**.

2. Check continuity through each suspect line by connecting test leads from ohmmeter to each end of **W13**.
   - Connect one test probe to **A17J1** pin connection on solder-side of **A17** Module.
   - Insert the other probe into end of cable **W13**. Select socket with same number as **A17J1** pin connection.

(**See Figure 3B-2 to determine pin 1 location**.)

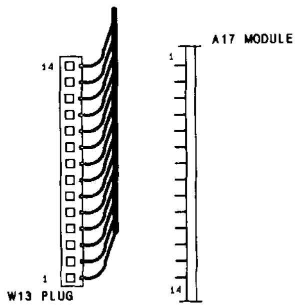
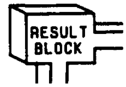



**Figure 3B-2. Cable W13 Connection Locator**

3. Record test results.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W13**.



## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Power Switch Test | **PS.06** |
| **Run time:** | 1 min. |  |
| **Set-up time:** | 6 min. | |

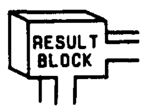
**Run Test**

1. Check Power Switch:
   - Open Front Panel. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate opening instructions.)
   - Check resistance between Power Switch output, on **A1 Module** at **A1A1 J1** pin **30,** and ground. Resistance should measure less than **2 ohms** in **ON** (recessed) position and greater than **500 ohms** in **Standby** position. (See Figure 3C-3 in **Control Section Diagnostics** for connector diagram.) * If switch responds as described, proceed to step 2, otherwise continue testing.
   - If switch does not respond as described, disconnect cable W15 from A1 Module at A1A1 J1 and retest switch. (Refer to table on foldout in MECHANICAL PROCEDURES to locate Al Module removal information.)
   - If switch still does not respond correctly, proceed to step 3, otherwise reconnect W15 to A1 and continue testing.

2. Check switch path:
   - Remove right side cover from instrument. (Refer to table on foldout in **MECHANICAL PROCEDURES** for removal information.) * Disconnect cable **W10** from **A17** Module at **A17J2.**
   - Plug end of **W10** into **34** pin test connector, from ON Site Service Kit.
   - Measure resistance at **pin 34** of **W10P2.** (Resistance should measure the same as in step 1.)

3. Record test results.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SWITCH**.



## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Voltage Check | **PS.07** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 2 min. | |

**External DC** voltmeter is used to test rectifier output levels with **A18 Module** isolated from **A17 Module.**

**<u>Run Test</u>**

1. Switch instrument to Standby and disconnect line power from instrument.

2. Disconnect cable **W13** from **A18** Module at **A18J3** (see **A17** & **A18** MODULE CABLE CONNECTION LOCATOR on foldout for **A18J3** location).
   - Pull straight up on **W13** to disconnect it from **A18J3**.

3. Reconnect power to instrument.

4. Measure voltage levels:
   - Use external DC voltmeter to measure voltage levels, with respect to ground, at fuses **A18F1 through 5**.
   - Leave fuses in instrument and measure voltage levels at both ends of each fuse holder for **F1 through 5**.
   - Voltage levels should be within ranges shown in following chart and should read the same at both ends of each fuse.

| Fuse Voltages, Vdc | | | | |
|---|---|---|---|---|
| F1 | F2 | F3 | F4 | F5 |
| +15 to +30 | -30 to -20 | +8 to +13 | -13 to -8 | +60 to +80 |

   - If all fuse holders measured good at both ends, proceed directly to step 6.
   - If any fuse holders measured bad at both ends, proceed directly to step 6, otherwise continue testing.

## POWER SUPPLY DIAGNOSTICS

**CAUTION**

Disconnect line power to instrument when removing or replacing fuses.

5. Replace blown fuses:
   - Use plastic Fuse Puller, from On-Site Service Kit, to remove fuses.

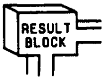
**NOTE**

Use side-notched end of Fuse Puller to hook fuse and pull it from instrument. Use end-notched end of Fuse Puller to place fuses in fuse holders or to pick up fuses dropped into instrument.

   - Replace blown fuses with a good fuse of proper rating from the On-Site Service Kit. (Fuse ratings are shown on Top View Diagram on inside of instrument's Top Cover at each fuse location.)
   - Reconnect power to instrument, switch (POWER)to ON position and repeat procedure beginning at step 3

6. Record test results.

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for ISOLATE **A18**.



## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4; AC Voltage Measurements | **PS.08** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 7 min. | |

**External AC** voltmeter is used to check voltages to **A18 Module** from **Transformer, T1. Run Test**

1. Switch instrument to **Standby** and disconnect line power from instrument.

**WARNING**

Removing rear bottom cover exposes Filter cap screw heads. Voltage potentials are still present at these screws even when power has been removed.

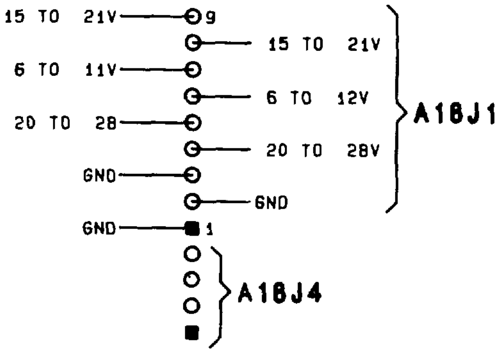
2. Remove instrument's rear bottom cover. (Refer to table on foldout in **MECHANICAL PROCEDURES** for removal information).

**WARNING**

Power Transformer **T1** should be isolated from Digital Multimeter. Use a portable Digital Multimeter that is not connected to the same power source as the instrument.

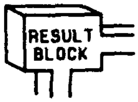
3. Measure voltage levels:
   - Connect voltmeter's ground lead to instrument's chassis.
   - Reconnect line power to instrument.
   - Measure AC voltages at **A18J1** (see **A17 & A18 MODULE CABLE CONNECTION** LOCATOR on the foldout to locate **A18J1**). See **Figure 3B-3** for voltage levels.

**Figure 3B-3 Connector A18J1 Signal Locator (Solder-Side of Board)**




4. Record test results.

5. Return to foldout:
   - Determine next task by comparing test Results to conditions shown in each for **TEST AC POWER**.



## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Supply Lines Test | **PS.09** |
| **Run time:** | 1 min. |  |
| **Set-up time:** | 6 min. | |



This test uses **Power Supply Test** Connector from On-Site Service Kit to isolate **Power Supply** Section from rest of instrument.

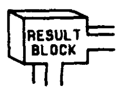
**<u>Run Test</u>**

1. Switch (POWER) to Standby and disconnect power plug.
2. Remove right side cover from instrument. (Refer to table on foldout in **MECHANICAL PROCEDURES** for removal information).
3. Disconnect cable **W10** from **A17 Module** at **A17J2**. (See **A17 & A18 MODULES CABLE CONNECTION LOCATOR** for **A17J2** location.)
4. Connect **Power Supply Test Connector** (HP 0**8**642-**8**0053) and 50 pin ribbon cable, from On-Site Service Kit, to **A17 Module** at **A17J2.**
5. Connect line power to instrument. **DO NOT** change **POWER Switch from Standby** position.

**NOTE**

**Find arrowhead on test connector and align with arrowhead on cable plug W9P2.**

6. Perform the following steps to Turn On Power Supply:
   - Connect one side of test lead to **GND (A4TP2).** (See **A17 & A18 MODULE CABLE CONNECTION LOCATOR** on foldout for **GND** location).
   - Connect other side of test lead to test point terminal on Power Supply Test Connector.
7. Measure voltage levels at test points **A17TP1 through 5**.
   (See **A17 &A18 MODULE CABLE CONNECTION LOCATOR** on foldout for **A17TP1 through 5** locations.) Voltage levels should be within approximately **1%** of those shown in chart on foldout.
8. Remove test connector:
   - Disconnect ground from **TP1** on test connector.
   - Disconnect **Power Supply Test Connector** and ribbon cable from **A17 Module.**
   - Reconnect cable **W10** to **A17** Module.
9. Record test results.
10. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **ISOLATE POWER SUPPLY**



## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Distribution Test | **PS.10** |
| **Run time:** | 1 min. per set-up |  |
| **Set-up time:** | Up to 1 5 min. | |

This test determines if **Power Supply Section** failure is due to over loading by **Control** or **RF** Sections.

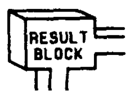
**<u>Run Test</u>**

1. Switch (POWER) to **Standby.**

**CAUTION**

**Be sure to use adequate Electrostatic Discharge (ESD) precautions when handling A3 and A4 Modules.**

2. Remove **A3** and **A4** modules from instrument (see Top View Diagram on inside Top Cover to locate **A3** and **A4**).
3. Switch [POWER] to **ON**.
4. Measure voltage levels at test points **A17TP1 through 5.**
   - If all voltage levels measure within **1%** of those shown in chart on foldout, proceed directly to step **10,** otherwise continue testing.
5. Switch [POWER] to **Standby**.
6. Beginning at left side of **AS Distribution Assembly**, disconnect ribbon cable **W1** from **A5** Assembly at **A5J1**. (See **A17 & A18 MODULES CABLE CONNECTIONS LOCATOR** on foldout to locate **J1** on **A5 Assembly**.) Refer to table on foldout in **MECHANICAL PROCEDURES** for information on disconnecting cables from **A5**.
7. Switch (POWER) to **ON.**
8. Measure voltage levels at test points **A17TP1 through 5.**
9. Repeat steps **5** through **8** for each ribbon cable connected to **A5** (except **W10**) or until Power Supply unloads.
10. Record test results. (If **Power Supply** unloads, suspect last cable and module disconnected from **A5** just before unloading occurred.)
11. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **IDENTIFY CAUSE**.



## POWER SUPPLY DIAGNOSTICS

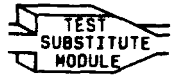
| | | |
|---|---|---|
| **Type:** | Module Substitution | **PS.11** |
| **Run time:** | 0 |  |
| **Set-up time:** | 20 min. | |

**<u>Connect Substitute Module</u>**

1. Refer to table shown on foldout in **MECHANICAL PROCEDURES** to locate removal and replacement procedures for module you have been directed to substitute.

2. Return to foldout.

## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **PS.12** |
| **Run time:** | 1 min. |  |
| **Set-up time:** | 2 min. | |

**External DC** Voltmeter is used to check power supply levels at **A17TP1 through 5.**

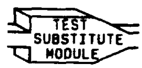
**<u>Run Test</u>**

1. Connect instrument's line power plug to a known good power source.
2. Switch (POWER) to ON position.
3. Connect external DC voltmeter ground lead to instrument's chassis.
4. Measure Power Supply output voltage levels on **A17** Module at test points **TP1 through 5**. (See **A17 & A18 MODULES CABLE CONNECTION LOCATOR** on foldout for test point locations and voltage levels.) Voltages should be within approximately **1%** of those shown in chart.
5. The tuning screws located next to **A17TP1 through 5**, can be used to fine tune voltage levels which are slightly **>1%** high or low.

**NOTE**

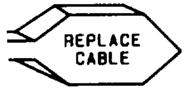
The voltages measured at A17TP1 through 5 are being fed back from sense points on the A5 Assembly. A correct measurement verifies the presence of the voltage on the A5 Distribution Assembly.

6. Record test results.
7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB MODULE**.



## POWER SUPPLY DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **PS.13** |
| **Run time:** | 5 min. | |
| **Set-up time:** | 1 min. | |




1. Testing has shown cable **W13** to be suspect.

2. Repair or replace **W13.**

3. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

## A17 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Control Signals Test | **A17.01** |
| Run Time: | 1 min. |  |
| **Set-up time:** | 0 | |

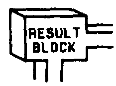
### Run Test

1. [INSERT PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [6] [2] [HZ]

3. When "**DIAG DONE HIT MSSG .V1**" appears:
   - Use (MSSG) to scroll through messages.
   - Record error code(s) displayed for **A17**. If "**TEST 1 OF A17** (**PASSED** or **FAILED**)" is not displayed, rerun test.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for TEST **A17 CONTROL BITS.**



## A17 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A17.02** |
| **Run time:** | 12 min. |  |
| **Set-up time:** | 2 min. | |



Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A17 Module** on **Attenuator Driver** control lines.

**NOTE**

If any control line level measures bad, it is not necessary to test remaining lines; proceed directly to step **14**.

**Run Test**

1. Switch ( POWER) to Standby:
   - Remove right side cover from instrument (refer to table on foldout in **MECHANICAL PROCEDURES** for information).
   - Disconnect cable **W9** from **A17** Module at **A17J3.**
   - Plug end of cable **W9** into **50** pin test connector, from On-Site Service Kit.

**NOTE**

**Find arrowhead on test connector and align with arrowhead on cable plug W9P2.**

**CAUTION**

**To prevent damage to the Control Section, do not permit the exposed pins on the test connector to short circuit.**

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A17 MODULE CABLE CONNECTION LOCATOR** on foldout for VM IN location.)

3. Switch (POWER) to **ON**.
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

Attenuator Driver Control Lines

**Check High State**

4. [SHIFT] [SPCL] [3] [6] [0] [1]
   To specify high state

5. **Enter Bit Select Keys**, as indicated in **Table 3B-1. W9P2 Control Bits**, for **Control Line** to be tested.

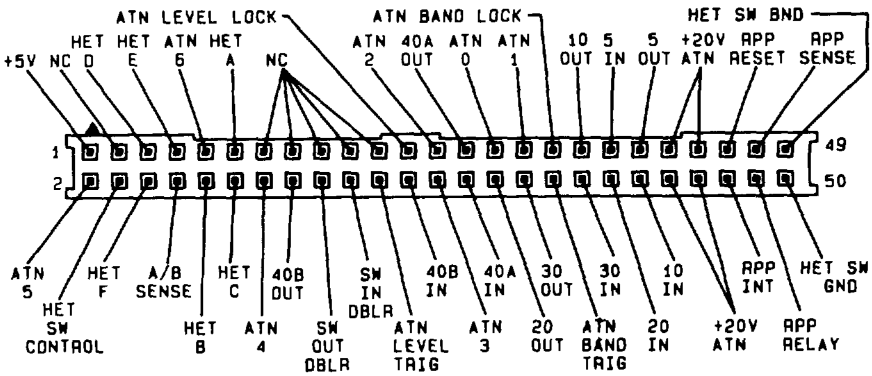
6. Connect **VM** probe to **Control Line at Pin Number** indicated in Table 3B-1. (See **Figure 3B-4. Cable Plug W9P2 Signal Locator**.)

**Table 3B-1. W9P2 Control Bits**

| Test Order | Control Line | Bit Select Keys (Steps 5 and 10) | Pin Number (Step 6) |
|---|---|---|---|
| 1 | ATN BAND TRIG | [5] [9] [HZ] | 34 |
| 2 | ATN LEVEL TRIG | [6] [2] [HZ] | 22 |
| 3 | ATN 0 | [6] [4] [HZ] | 29 |
| 4 | ATN 1 | [6] [5] [HZ] | 31 |
| 5 | ATN 2 | [6] [6] [HZ] | 25 |
| 6 | ATN 3 | [6] [7] [HZ] | 26 |
| 7 | ATN 4 | [6] [8] [HZ] | 14 |
| 8 | ATN 5 | [6] [9] [HZ] | 2 |
| 9 | ATN 6 | [7] [0] [HZ] | 9 |

## A17 MODULE DIAGNOSTICS

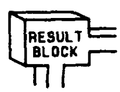
**Figure 3B-4. Cable Plug W9P2 Signal Locator**




7. [2] [5] [HZ[
   To enable voltmeter.)
8. Voltage should read approximately +2.5 to +5.5 Vdc.
   [5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify low state.)
10. Enter Bit Select Keys, as indicated in **Table 3B-1. W9PZ Control Bits**, for same **Control Line.**
11. [2] [5] [HZ].
    (To enable voltmeter.)
12. Voltage should read approximately -0.5 to +1.5 Vdc
    [5] [HZ] to repeat measurement.)
13. Repeat procedure for each **Control Line** shown in **Table 3B-1.**
14. Record test results.
15. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST ATN CONTROL BITS**.



## A17 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A17.03** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A17** on **Reverse Power Reset** line.

**<u>Run Test</u>**

1. Switch (POWER) to Standby:
   - Remove right side cover from instrument (refer to table on foldout in **MECHANICAL PROCEDURES** for removal information).
   - Disconnect cable **W9** from module at **A17J3.**
   - Plug end of **W9 into 50** pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W9P2.**

**<u>CAUTION</u>**

Do not permit the exposed pins on the test connector to short circuit.

2. Connect VM probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to VM IN (A4TP1). (See **A17 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

3. Switch [POWER] on.
   [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ -140.0DM**" appears, to override 20 second reset test.

**<u>Reverse Power Protection Reset</u>**

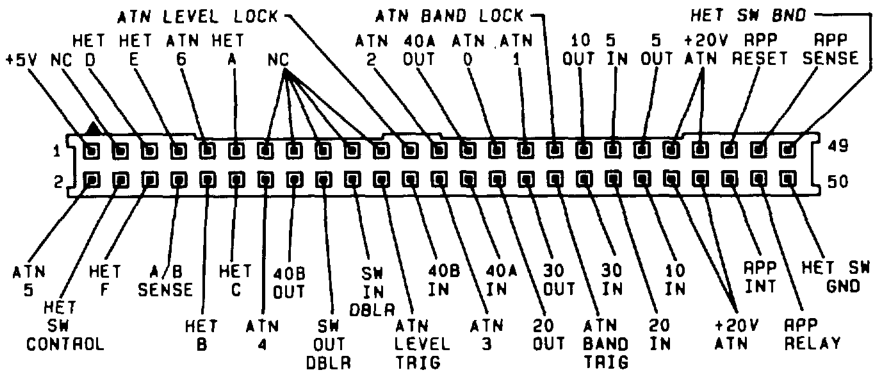
**Check High State**

4. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify high state.)

5. [5] [3] [HZ]

6. Connect **VM** probe to test connector line **RPP Reset** (pin **45**). (See **Figure 3B-6. Cable Plug W9P2 Signal Locator.)**

**Figure 3B-6. Cable Plug W9P2 Signal Locator**

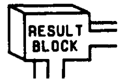



7. [2] [5] [HZ]
(To enable voltmeter.)

8. Voltage should read approximately +2.5 to +5.5 Vdc.
([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify low state.)
10. [6] [3] [HZ]
To select bit.
11. [2] [5] [HZ]
To enable voltmeter.)
12. Voltage should read approximately **-0.5 to +1.5 Vdc**.
([5] [HZ] to repeat measurement.)
13. Record test results.
14. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST RPP RESET BIT.**



## A 17 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A17.04** |
| **Run time:** | 2 min. |  |
| Set-up time | 2 min. | |

Internal Voltmeter (**VM**) is used to measure **TTL** level changes transmitted to **A17** on **Heterodyne Switch** control line.

**<u>Run Test</u>**

1. Switch (POWER) to **Standby:**
   - Remove right side cover from instrument. (Refer to table on foldout in **MECHANICAL PROCEDURES** for removal information).
   - Disconnect cable **W9** from module at **A17J3.**
   - Plug end of **W9** into 50 pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W9PZ.**

**<u>CAUTION</u>**

To prevent damage to the Control Section, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN** (**A4TP1**). (See **A17 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

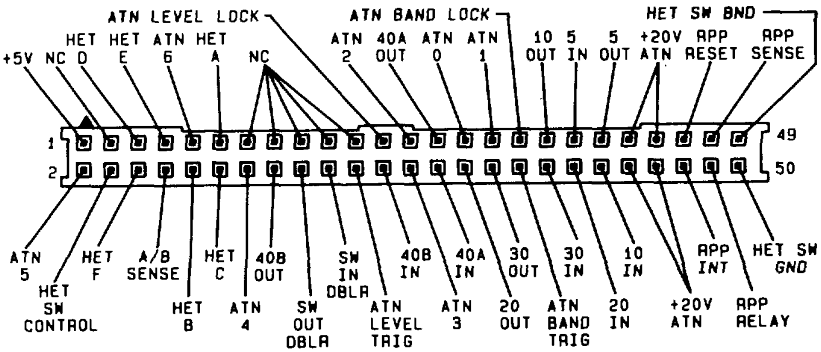
3. Turn instrument on.
   [INSTR PRESET] [SHIFT]
   (Hold shift key until **"10.000000MZ -140.0DM"** appears, to override 20 second reset test.

**<u>Heterodyne Switch Control Line</u>**
**Check High State**

4. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify high state.)

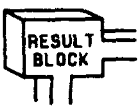
5. [7] [1] [HZ]
   (To select bit)
6. Connect **VM** probe to test connector line **HET SW CONTROL** (pin 4). (See **Figure 3B-5. Cable Plug W9P2 Signal Locator.)**

**Figure 3B-5. Cable Plug W9P2 Signal Locator**




7. Enable voltmeter.)
**8**. Voltage should read approximately **+2.5 to +5.5 Vdc**.
   ([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify low state.)
10. [7] [1] [HZ]
    (To select bit)
11. [2] [5)][HZ]
    (To enable voltmeter meter.)
12. Voltage should read approximately **-0.5 to +1.5 Vdc.**
    [5] [HZ] to repeat measurement.)
13. Record test results.
14. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each 

      for **TEST HET CONTROL BIT**.

## A17 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A17.05** |
| **Run time:** | 0 | |
| **Set-up time:** | 22 min. |  |



**<u>Connect Substitute Module</u>**

1. Return to table shown on foldout in **MECHANICAL PROCEDURES** to locate **A17 Module** removal and replacement procedures.
2. Return to **A17 MODULE SUBSTITUTION** on foldout.

## A17 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A 17.06** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

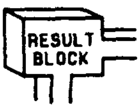
The **A17** failure conditions for arriving at this task are described below. Follow the procedure for the condition which best fits your module.

**Condition 1:** **A17 INPUTS VERIFICATION** indicated **A17** failure.

**Condition 2**: **Instrument Level Self Test** indicated **A17** failure.

**Condition 3:** **Module Level Diagnostics (MLD)** for **A14**, **A16,** or **A19** indicated **A17** failure.

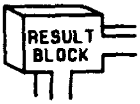
**<u>Condition 1</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [6] [2] [HZ]
3. When **"DIAG DONE HIT MSSG .V1"** appears:
   - Use f MSSG j to scroll through messages.
   - Record error code(s) displayed for **A17**. If "**TEST 1 OF A17** (**PASSED** or **FAILED**)" is not displayed, rerun test.
4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each  for **TEST SUB A17.**

**<u>Condition 2</u>**

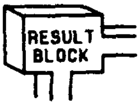
1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [0] [HZ]

**A17 MODULE DIAGNOSTICS**

3. When "**WAITING FOR SET-UP 1 .24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to "**FM/ΦM INPUT**" (see **ILD** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue test.
4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [ MSSG 1 to scroll through messages.
   - Record any error code(s) displayed for **A1**7;
5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

for **TEST SUB A17.**

**Condition 3**

1. Rerun test which indicated **A17** failure.
2. Record test result.
3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

for **TEST SUB A17**.

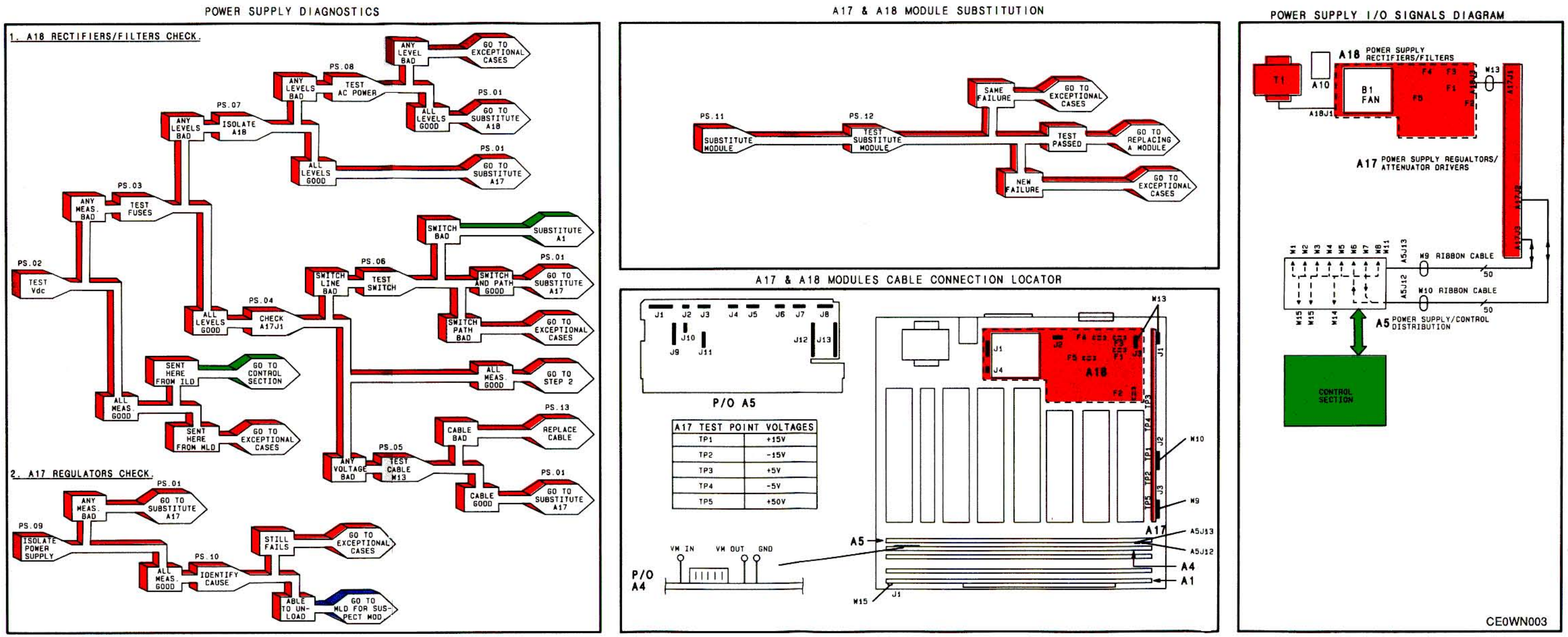



Figure 3B-100. A18 Rectifier/Filters Module and P/O Power Supply Regulators /Attenuator Drivers Module Diagnostics

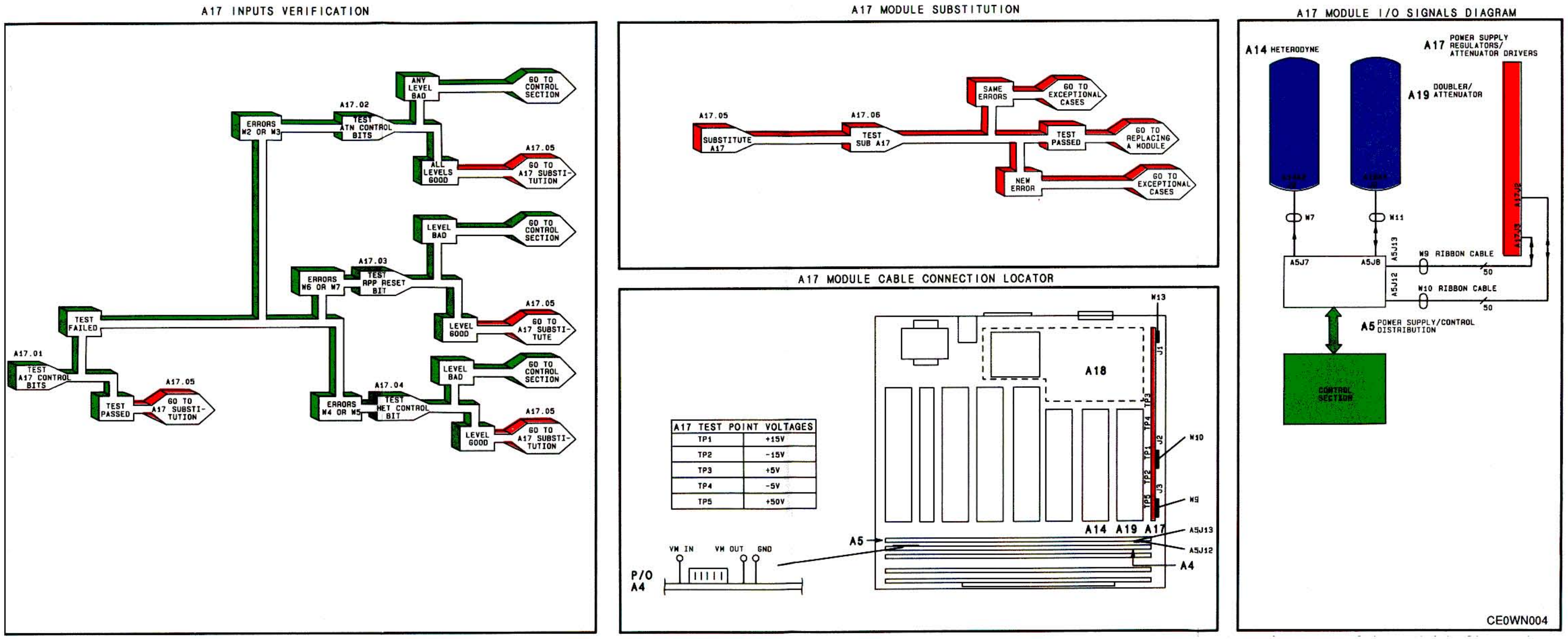



Figure 3B-200. A17 P/O Power Supply Regulators /Attenuator Drivers Module Diagnostics

## CONTROL SECTION DIAGNOSTICS

### 3C-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **Control Section** Modules: **A1 Keyboard/LCD Display Module, A3 Processor/ Memory Module**, and **A4 Latch Module**. The objective is to isolate the failure indicated for this section to a module or to a part on which the **Control Section** depends for operation.

**NOTES**

At this level of testing, it is assumed that the Power Supply is operational. If there is any doubt, turn to the Power Supply Section to begin troubleshooting.

If **Test 4** of **A3** failed (error message **.U506**) check that **A3S2**, is in its **PROTECTED** position. (See CONTROL SECTION CONNECTOR LOCATOR diagram on the foldout at the end of this section to locate **A3S2**.) If **A3S2** is not in its **PROTECTED** position, move it to that position now and rerun the Instrument Level Diagnostics. If **A3S2** is in its **PROTECTED** position, proceed with the Control Section Diagnostics.

**Test Instructions**

1. The instrument's **Top Cover** must be removed to run many of these tests. (Refer to the table shown on the foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. **The last page in this group of tests is a foldout and should be pulled out now.**

3. Testing in this section is divided into three parts, one part for each of the **three** Control Section modules: **A4, A3, A1.**

4. Begin the **Control Section Diagnostics** by reading the next page.

## 3C-2. INTRODUCTION

The first step in isolating a Control Section failure is to substitute in a known good **A4 Module** from the On-site Service Kit.

### A4 Substitution Instructions

1. Find **A4 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A4 MODULE SUBSTITUTION** to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the page indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

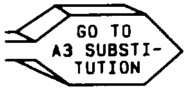
**NOTE**

The **CONTROL SECTION I/O SIGNALS DIAGRAM** shows all parts which the control modules depend on for operation.

## A3 MODULE SUBSTITUTION

### 3C-3. INTRODUCTION

CTL.01




To isolate a **Control Section** failure to the **A3 Module**, substitute in a known good module from the On-Site Service Kit.

**<u>A3 Substitution Instructions</u>**

1. Find **A3 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A3 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they appear in this section. Turn to the task indicated and complete the procedure.

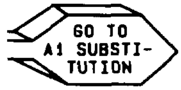
3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A1 MODULE SUBSTITUTION

### 3C-4. INTRODUCTION

CTL.02




To isolate a Control Section failure to the **A1 Module**, substitute in a known good module from the On-Site Service Kit.

**A1 Substitution Instructions**

1. Find **A1 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A1 MODULE SUBSTITUTION** to direct you through the substitution process. Each task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered in the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

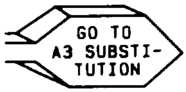
3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A3 MODULE SUBSTITUTION

### 3C-3. INTRODUCTION

CTL.01




To isolate a **Control Section** failure to the **A3 Module**, substitute in a known good module from the On-Site Service Kit.

**A3 Substitution Instructions**

1. Find **A3 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A3 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they appear in this section. Turn to the task indicated and complete the procedure.

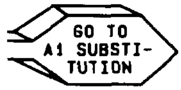
3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A1 MODULE SUBSTITUTION

CTL.02

### 3C-4. INTRODUCTION




To isolate a Control Section failure to the **A1 Module**, substitute in a known good module from the On-Site Service Kit.

**<u>A1 Substitution Instructions</u>**

1. Find **A1 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A1 MODULE SUBSTITUTION** to direct you through the substitution process. Each task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered in the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **CTL.03** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 0 min. | |

**External DC** voltmeter is used to test power supply levels at **A4** Module.

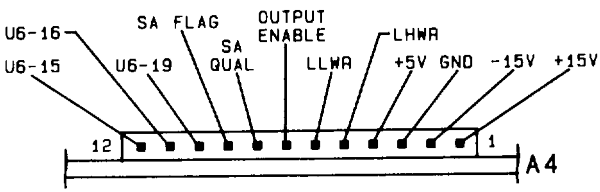
**<u>Run Test</u>**

1. Turn instrument on.

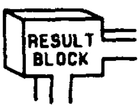
2. Connect external **DC** voltmeter ground lead to **A4 Module** at **A4TP2 (GND).** (See **CONTROL SECTION CONNECTOR LOCATOR** on foldout to locate ground post.)

3. Measure power supply voltage levels:
   - Connect test probe to **A4 Service Test Points** pins 1, 2 and 4 (see **Figure 3C-1. A4J1** Service Test Point Signal Locator).

**Figure 3C-1. A4J1 Service Test Points**
**Signal Locator**




4. Record test results.

5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each  for **TEST A4 Vdc**.

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Tests | **CTL.04** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

The **Control Section** Failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your instrument.

**Condition 1:** **Instrument Level Diagnostics (ILD**) indicated Control Section failure.

**Condition 2:** **Module Level Diagnostics (MLD)** for another module indicated Control Section failure.

**Condition 3:** Instrument must be **set to a specific operating condition** to **detect Control Section** failure.

**Condition 1**

**NOTE**

If you were sent to the Control Section because the instrument was unable to complete the **Instrument Level Self Test**, return to the foldout now and proceed with the **A4** substitution process.

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.

2. [SHIFT] [SPCL] [3] [3] [0] [HZ]

3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to "**FM/ΦM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue test.

4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use (MSSG) to scroll through messages.
   - Record test results.

5. Return to foldout.

## CONTROL SECTION DIAGNOSTICS

**Condition 2**

1. Rerun test which indicates Control Section failure.
2. Record test results.
3. Return to foldout.

**Condition 3**

1. Set instrument to operating condition which causes Control Section failure.
2. Record instrument set-up and error message(s).
3. Return to foldout.

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **CTL.OS5** |
| **Run time:** | 0 |  |
| **Set-up time:** | 2 min. | |

**Substitute Module**

1. Switch instrument to Standby.

2. Remove **A4 Module** from instrument. (Refer to table on foldout in **MECHANICAL PROCEDURES** for location of removal information.)

3. Replace **A4 Module** with a **known good module** from On-Site Service Kit.

4. Turn instrument on.

5. Return to foldout.

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Tests | **CTL.06** |
| **Run time:** | Conditional |   |
| **Set-up time:** | Conditional | |

Test operation of substitute module by repeating test(s) performed on module before substitution.

**Condition 1:** **Instrument Level Diagnostics (ILD)** indicated **Control Section** failure.

**Condition 2:** **Module Level Diagnostics (MLD)** for another module indicated **Control Section** failure.

**Condition 3**: Instrument must be set to a specific **operating condition** to detect **Control Section** failure.

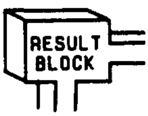
**<u>Condition 1</u>**

1. [SHIFT] [SPCL] [3] [3] [0] [HZ]

2. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/ΦM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue test.

3. When "**DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record test results.

4. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each



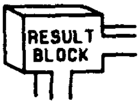

for **TEST SUB MODULE**.

## CONTROL SECTION DIAGNOSTICS

**Condition 2**

1. Rerun test which indicates **Control Section** failure.

2. Record test results.

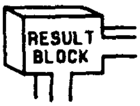
3. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each 

for **TEST SUB MODULE.**

**Condition 3**

1. Set instrument to operating condition which causes Control Section failure.

2. Record instrument set-up and error message(s).

3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

for **TEST SUB MODULE**

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **CTL.07** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 0 min. | |

**External DC** voltmeter is used to test power supply levels at **A3 Module**.

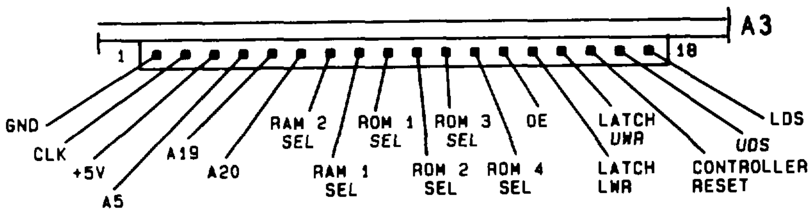
**<u>Run Test</u>**

1. Turn instrument on.

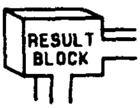
2. Connect external DC voltmeter ground lead to **A4 Module** at **A4TP2 (GND).** (See **CONTROL SECTION CONNECTOR LOCATOR** on foldout to locate ground post.)

3. Measure power supply voltage levels:
   - Connect test probe to **A3 Service Test Points** (see **Figure 3C-2. A3J4 Service Test Point Signal Locator).**

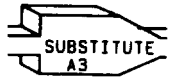
**Figure 3C-2. A3J4 Service Test Point Signal Locator**




4. Record test results.

5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each  for **TEST A3 Vdc.**

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **CTL..08** |
| **Run time:** | 1 min. |  |
| **Set-up time:** | 3 min. | |

In order for the instrument to operate correctly with substitute **A3 Module**, it is necessary to transfer Calibration Data from instrument's **A20 Calibration Module** to substitute A3 Module.

**<u>Substitute Module</u>**

1. Switch instrument to Standby.

2. **Remove A3** Module from instrument. (Refer to foldout in **MECHANICAL PROCEDURES** to locate removal information.)

3. **Replace A3 Module** with a known good module from ON Site Service Kit.

**<u>Down-Load Cal Data</u>**

**CAUTION**

Use adequate Electrostatic Discharge Techniques when handling the A20 Calibration Module.

4. Remove **A20 Calibration Module** from **Rear Panel**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate removal information.)

**CAUTION**

Check that switch S1 on A20 Module is switched up to its "**PROTECTED**" position.

The Calibration Data stored on the A20 Module and in the instrument will be destroyed by misapplied electrical signals.

## CONTROL SECTION DIAGNOSTICS

5. Switch instrument to Standby.

6. Connect **A20 Module** to **A3 Module** at **A3J3** (see **CONTROL SECTION CONNECTOR LOCATOR** on foldout).

7. Turn instrument on.

**8**. When **"100.000000 MZ -140.00 DM"** appears:
   - Slide switch on left side **of A3S2** (on **A3 Module**) back toward rear of instrument (see **CONTROL SECTION CONNECTOR LOCATOR** on foldout).

9. [SHIFT] [SPCL] [3] [7] [5] [HZ]

10. When "**TRANSFER VERIFIED .U613"** appears:
    - Slide **A3S2** forward, toward front of instrument to protect **A3 Module's** memory.

11. Switch instrument to **Standby** and remove **A20 Module**.
    **Replace A20 Module on Rear Panel of instrument.**

12. Return to foldout.

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **CTL.09** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 6 min. | |

**External DC** Voltmeter is used to check power supply levels at inputs to **A1 Module**.

**<u>Run Test</u>**

1. Turn instrument on.

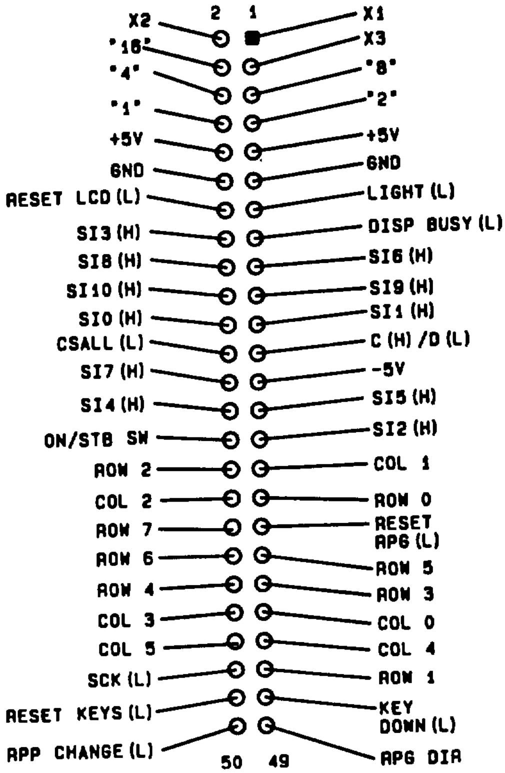
2. Connect **external DC** voltmeter ground lead to **A4** Module at **A4TPZ (GND**). See **CONTROL SECTION CONNECTOR LOCATOR** on foldout to locate ground post.)

**CAUTION**

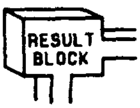
Opening the Front Panel without following the instructions presented in the MECHANICAL PROCEDURES section may cause damage to the Front Panel.

3. Measure voltage levels at **A1A1 J1**:
   - Open Front Panel. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate Front Panel information.)
   - Access signals from solder-side of **A1A1J1.** (See **CONTROL SECTION CONNECTOR LOCATOR** on foldout to locate **A1A1 J1**.)
   - Voltage levels and locations are shown in **Figure 3C-3.**

**Figure 3C-3. Connector A1A1 J1 Signal Locator**




4. Record test results.

5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each 

 for **TEST A1 Vdc.**

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **CTL.10** |
| **Run time:** | 0 |   |
| **Set-up time:** | 10 min. | |

**Substitute Module**

1. Switch instrument to **Standby** and disconnect power plug.

2. Remove **A1 Module** from instrument. (Refer to table on foldout in **MECHANICAL PROCEDURES** for location of removal information).

3. Replace module with a known good **A1 Module** from On-Site Service Kit.

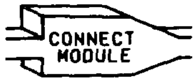
**NOTE**

To set-up the substitute Al Module for testing, simply connect cables at A1A1 JI and A1A1 J3 on substitute module and attach module to front panel with four nuts (I at each corner).

4. Return to foldout.

## CONTROL SECTION DIAGNOSTICS

| | | |
|---|---|---|
| **Type**: | Module Substitution | **CTL.11** |
| **Run time**: | 0 | |
| **Set-up time**: | 2 - 4 min. | |




**Replace Module**

1. Switch instrument to **Standby** (if you are replacing **A1 Module** disconnect line power also).

2. Remove substitute module from instrument and return to On-Site Service Kit.

3. Replace instrument's module in instrument. (Refer to foldout in **MECHANICAL PROCEDURES** to locate replacement information.)

4. Turn instrument on.

5. Return to foldout.

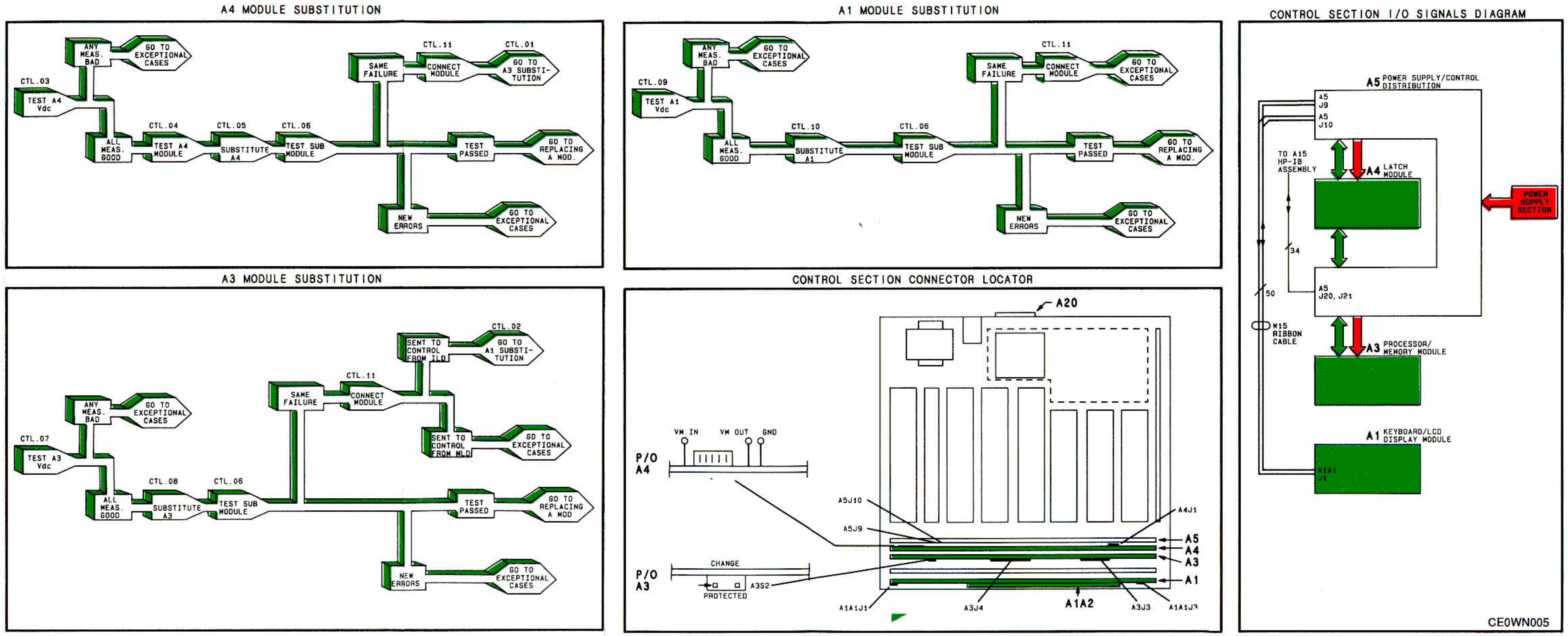



Figure 3C-100. A1, A3 AND A4 Control Section Diagnostics.

## 3D-1. DELETED.

## A2 MODULATION MODULE

### 3E-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A2 Module**. The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01, A03** or **A04**. (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or .74 ft-lbs (slightly tighter than finger tight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptible to short circuiting.

**Test Instructions**

1. The instrument's **Front Panel** must be opened to run many of these tests. (Refer to the table on the foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. The last page in this group of tests is a foldout and should be pulled out now.

3. Proceed to the next page to begin the **A2 MLD**.

## A2 MODULE SUBSTITUTION

### 3E-2. INTRODUCTION

**NOTE**

If a known good module is not available, proceed to the next page **A2 INPUTS/OUTPUTS VERIFICATION.**

The first step in isolating an **A2** failure is to substitute in a known good module from the On-Site Service Kit.

**A2 Substitution Instructions**

1. Find **A2 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A2 MODULE SUBSTITUTION** to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they appear in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A2 INPUTS/OUTPUTS VERIFICATION

### 3E-3. INTRODUCTION

A2.01


If a known good **A2 Module** is not available, or if you were not able to isolate the failure using the **A2 MODULE SUBSTITUTION** procedure the Task Sequence Diagrams (shown under **A2 INPUTS/OUTPUTS VERIFICATION**) should be used to check each signal path into the A2 Module.

**<u>A2 Inputs /Outputs Verification Instructions</u>**

1. Find **A2 INPUTS/OUTPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown under **A2 INPUTS/OUTPUTS VERIFICATION**, are separated into four checks: **Modulation Input/Output Ports, Audio to Instrument, Control** signals, and **Power Supply** signals.

3. Use the Task Sequence Diagrams to guide you through the verification process. Each Task Arrow shown in a diagram contains a task number and task title. The tasks are numbered according to the order in which they appear in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under
   **1. MODULATION I/O PORTS CHECK**.

**NOTE**

The **A2 MODULE I/O SIGNALS DIAGRAM** shows all parts directly associated with modulation.

## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Modulation Self Test | **A2.02** |
| **Run time:** | I min. | |
| **Set-up time:** | I min. | |


### Run Test

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ  -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [1] [6] [HZ]

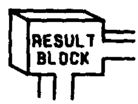
3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/FM INPUT**".  (See foldout in **INSTRUMENT LEVEL DIAGNOSTICS (ILD**) for set-up diagram.)
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a cable from Tee to "**AM INPUT**".
   - [HZ] to continue test.

4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.

**NOTE**

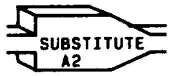
If any error codes are displayed for modules A01, A03, or A04, you need to isolate those failure(s) before performing the A2 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to  determine correct order for troubleshooting modules.)

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST A2 MODULE**.



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A2.03** |
| **Run time:** | 0 | |
| **Set-up time:** | 5 min | |




The following describes the technique for connecting a known good A2 Module without removing the A2 Module in the instrument.

**<u>Connect Substitute Module</u>**

1. Switch instrument to Standby.

2. Disconnect all cables to **A2 Module**; **W14**, **W17** through **22** and **W33**. (See **A2 MODULE CABLE CONNECTION LOCATOR** on foldout.)
   - Clip cable ties holding cable bundle to module ties.

3. Without removing **A2 Module** from instrument, carefully lay substitute **A2 Module** against **A2 Module** in instrument.

4. Connect cables **W14, W17 through 22** and **W33** to substitute module.

5. Pivot substitute **A2 Module** away from **A2 Module** in instrument.
   - Support from cables should allow substitute module to be placed in a free standing position.

**CAUTION**

If circuit side of substitute A2 is permitted to contact A2 Module in instrument, damage could result to either module. If Front Panel contacts substitute A2 Module, damage could result to substitute A2 Module.

6. Carefully turn instrument on.

7. Return to foldout.

## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A2.04** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 1 min. | |


Test operation of substitute **A2 Module** by repeating test performed on A2 Module before substitution.

**CAUTION**

Do not allow Front Panel to swing against substitute A2 Module while instrument is turned on.

### Run Test

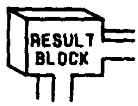
1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ   -140.0DMZ**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [3] [1] [6] [HZ]

3. When "**WAITING FOR SET-UP 1 ,V24**" appears:
   - Use same set-up as in previous test.

4. When **"DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for A2.

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A2.**



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A2 Tests | **A2.05** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |


The **A2 Module** failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1**: Instrument Level Diagnostics indicated **A2** failure.
**Condition 2** Failure indicated for another module appears to be **modulation related**.
**Condition 3**: Instrument must be set to a specific operating condition to detect **A2** failure.

**Condition 1**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100,000000 MZ -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [0] [HZ]

3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit to **"FM/FM INPUT"** (See foldout in **INSTRUMENT LEVEL DIAGNOSTICS (ILD**) for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - CFM to continue test.

4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use ([MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.

**NOTE**

If any error codes are displayed for modules A01, A03, or A04, you need to isolate those failure(s) before performing the A2 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

5. Return to foldout.

## A2 MODULE DIAGNOSTICS

**Condition 2**

1. Rerun test which generates modulation related failures.
2. Record test results.
3. Return to foldout.

**Condition 3**

1. Set instrument to operating condition which causes **A2** failure.
2. Record instrument set-up and error messages.
3. Return to foldout.

## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute A2 Tests | **A2.06** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |


Test operation of substitute **A2 Modul**e by repeating test(s) performed on A2 Module before substitution.

**Condition 1:** **Instrument Level Diagnostics** indicated **A2** failure.
**Condition 2**: Failure indicated for another module appears to be **modulation related**.
**Condition 3**: Instrument must be set to a specific operating condition to detect **A2** failure.

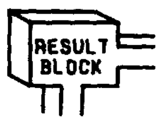
**Condition 1**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [0] [HZ]
3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit to "**FM/FM INPUT**" (See foldout in **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** for set-up diagram).
   - Connect a coax cable from Tee connector to "MOD OUTPUT".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [ HZ ] to continue test.
4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.

**NOTE**

If any error codes are displayed for modules A01 A03, or A04, you need to isolate those failure(s) now.

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A2 FURTHER.**



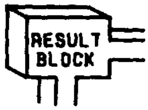
## A2 MODULE DIAGNOSTICS

**Condition 2**

1. Rerun test which generates modulation related failures

2. Record test results.

3. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A2 FURTHER.**

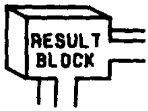



**Condition 3**

1. Set instrument to operating condition which causes **A2** failure.

2. Record instrument set-up and error message(s).

3. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A2 FURTHER**..



| | | |
|---|---|---|
| **Type:** | Cable Connection | **A2.07** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 5 min. | |


**<u>Connect Module</u>**

1. Switch instrument to **Standby**.

2. Disconnect cables **W14**, **W17** through **W22** and **W33** from substitute **A2 Module.**

3. Reconnect cables **W14**, **W17** through **W22** and **W33** to **A2 Module** and replace cable ties holding cable bundles to module with ties provided in On-Site Service Kit.

4. Turn instrument on.

5. Return substitute **A2 Module** to On-Site Service Kit.

6. Return to foldout.

## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Modulation Self Test | **A2.08** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 1 min. | |


This is the same test used to test **A2 Module** during module substitution process. If you made an accurate record of test results for that test, it is not necessary to rerun test now; instead proceed directly to step **5**.

**<u>Run Test</u>**

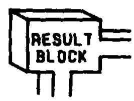
1. [INSTR] [PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [1] [6] [HZ]

3. When **"WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to "**FM/FM INPUT**" (see foldout in **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue test.

4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST MOD PORTS**.



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Modulation Self Test | **A2.09** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 6 min. | |


Cable **W21** is tested by by-passing it during testing.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)

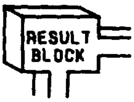
2. [SHIFT] [SPCL] [3] [3] [1] [6] [HZ]

3. When **"WAITING FOR SET-UP 1 .V24**" appears:
   - Connect **"FM/ΦM INPUT", "MOD OUTPUT**" and **"AM INPUT"** same as previous test.

4. Test cable **W21**:
   - Disconnect cable **W21** from **A2 Module** at **A2J8** (see **A2 MODULE CABLE CONNECTION LOCATOR** on foldout) and from **A6 Module** at **A6A2 J3** (see **Top View Diagram** on inside of Top Cover to locate **W21** connection on **A6 Module**). (See table on foldout in **MECHANICAL PROCEDURES** to locate Top Cover removal information.)
   - Substitute test coax cable from On-Site Service Kit between **A2J8** and **A6 Module** at **A6A2 J3**.
   - [HZ] to continue.

5. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Reconnect cable **W21** to modules **A2** and **A6**.
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2.**

6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W21**.



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Modulation Self Test | **A2.10** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 8 min. | |


Cables **W17**, **W18** and **W19** are tested by separately by-passing each cable and rerunning test.

**Test Cable W19**

1. [INSTR RESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [1] [6] [HZ]

3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect BNC Tee connector from "**FM/FM INPUT**"; leave BNC cables connected to "**MOD OUTPUT**" and "**AM INPUT**" as in previous test.
   - Connect BNC-to-SMC adapter, SMC barrel adapter, and test coax cable (from On-Site Service Kit) to Tee connector.

4. Connect substitute cable:
   - Disconnect cable **W19** from **A2 Module** at **A2J5**. (See **A2 MODULE CABLE CONNECTIONS LOCATOR** on foldout to locate **A2JS**.)
   - Connect the coax cable from Tee connector to **A2 Module** at **A2J5**.
   - [HZ] to continue.

5. When **"DIAG DONE HIT MSSGS.V1"** appears:
   - Reconnect cable **W19** to **A2 Module**.
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.

**Test Cable W17**

6. Repeat steps **1** and **2**.

7. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect BNC cable from "**MOD OUTPUT**" and connect to "**FM/FM INPUT**".

8. Connect substitute cable:
   - Disconnect cable W17 from **A2 Module** at **A2J7**.
   - Connect loose end of test cable to **A2 Module** at **A2J7**.
   - [HZ] to continue test.

9. When **"DIAG DONE   HIT MSSGS .V1"** appears:
   - Reconnect cable **W17** to **A2 Module**.
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.

**Test cable W18**

10. Repeat steps **1** and **2**.

11. When **"WAITING FOR SET-UP 1  .V24**" appears:
    - Disconnect BNC cable from "**AM INPUT**" and connect to **"MOD OUTPUT".**

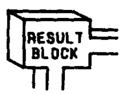
12. To connect substitute cable:
    - Disconnect cable **W18** from **A2 Module** at **A2J2**.
    - Connect loose end of test cable to **A2 Module** at **A2J2**.
    - [HZ] to continue test.

13. When "**DIAG DONE   HIT MSSGS ,V**" appears:
    - Reconnect cable **W18** to **A2 Module**.
    - Use [MSSG] to scroll through messages.
    - Record error code(s) displayed for **A2**.

**NOTE**

If tests did not pass for any of the cable substitution attempts, you should have gotten the same error set for each test. If you did not get the same errors, recheck cable connections and rerun test.

14. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CABLES W17, 18** and **19.**



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2; Audio Output Levels | **A2.11** |
| **Run time:** | 30 sec. | |
| **Set-up time:** | 6 min. | |


**Run Test**

1. [INSTR] [PRESET] [SHIFT]
   (Hold shift key until "**10.000000 MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [1] [7] [HZ]

3. When **"WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect cable **W22** from **A13 Module** at **A13A2 J4** (See Top View Diagram inside Top Cover to locate **W22** on **A13**).
   - Connect cable **W22** to "**AM INPUT**" using BNC cable and BNC-to-SMC adapter with barrel adapter from On-Site Service Kit.

**CAUTION**

Extending the A9 Module exposes the circuit side of the A17 Power Supply Regulators/Attenuator Drivers Module. Do not permit the loose end of W33 to contact the A17 Module.

   - Disconnect cable **W33** from **A19 Module** at **A19A1J6**. To access **A19A1J6,** extend **A19 Module**. (See table on foldout in **MECHANICAL PROCEDURES** for module extending information.)
   - Connect cable **W33** to "**FM/FM INPUT**" using cabling method described for **W22**.
   - [HZ] to continue.

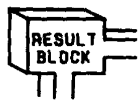
## A2 MODULE DIAGNOSTICS

4. When "**WAITING FOR SET-UP 2  .V25**" appears:
   - Reconnect cables **W22, W33** to modules.
   - Disconnect cable **W20** from **A6** Module at **A6A1 J4**.
   - Connect cable **W20** to "**AM INPUT**".
   - Connect "**FM/FM INPUT**" to **"MOD OUTPUT**".
   - [HZ] to continue.

5. When **"RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W20** to **A6 Module**.
   - [HZ] to continue.

6. When **"DIAG DONE HIT MSSGS .V1**" appears:
   - Use (MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.
   - **If "TEST 2 OF A02 (PASSED** or **FAILED)"** is not displayed, rerun test.

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST AUDIO TO A6, 13** and **19.**



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2; Audio Output Levels | **A2.12** |
| **Run time:** | 30 sec. | |
| **Set-up time:** | 5 min. | |


Cables **W20, W22** and **W23** are tested by substituting in a test cable for each of these cables during testing.

**Run Test**

1. [INSTR] [PRESET] [SHIFT]
   (Hold shift key until "**100.00000MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [1] [7] [HZ]

3. When **"WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect cable **W22** from **A2 Module** at **A2J3** (see **MODULE CABLE CONNECTION LOCATOR** on fold-out to locate **W22**). (See table on foldout in **MECHANICAL PROCEDURES** for opening Front Panel information.)
   - Using BNC cable and BNC-to-SMC adapter, SMC barrel, and SMC coax cable from On-Site Service Kit. connect **A2 Module** (at **A2J3**) to. "**AM INPUT**".
   - If an **HP 8642A** is being tested, push [HZ] now and proceed to step **4**.
   - If an **HP 8642B** is being tested, disconnect cable **W33** from **A2** Module at **A2J4**.
   - Using same cabling method described for **W22**, connect **A2** Module (at **A2J4**) to **"FM/FM INPUT**"

4. When **"WAITING FOR SET-UP 2 .V25**" appears:
   - Reconnect cables **W22** and **W33** to **A2 Module**.
   - Disconnect cable **W20** from **A2 Module** at **A2J6**.
   - Connect **A2 Module** (at **A2J6**) to "**AM INPUT**".
   - Connect **"FM/FM INPUT**" to "**MOD OUTPUT**".
   - [HZ} to continue.

5. When **"RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W20** to **A2 Module**.
   - [HZ]to continue.

6. When **"DIAG DONE HIT MSSGS.V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A2**.
   - If "**TEST 2 OF A02 (PASSED** or **FAILED)**" is not displayed, rerun test.

7. If test failed, proceed directly to step **8**, otherwise continue testing.
   - A passing test indicates that one of the by-passed cables (**W20**, **W22** or **W23**) was cause of failure.
   - To isolate defective cable, rerun test two more times connecting cables as follows:

     **Test 1**: Connect cables **W22** and **W33** as described in step **3** of this test (by-passed). Connect **W20** as described in step **4** of previous test (not by-passed).

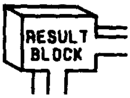
     **Test 2**: Connect cable **W22** as described in previous test (not by-passed). Connect **W33** and **W20** as described in this test (by-passed).

   - Use the following chart to determine defective cable:

| Test 1 | Test 2 | Defective Cable(s) |
|---|---|---|
| F | P | W20 |
| P | F | W22 |
| F | F | Cables W20 and W22 |
| P | P | W33 |

## A2 MODULE DIAGNOSTICS

8. When testing is complete, return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLES W20, 22 and 33**.



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A2.13** |
| **Run time:** | 6 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter (**VM**) is used to measure TTL level changes transmitted to **A2 Module** on Clock and Data control lines **D0** through **D7**.

**NOTES**

Check control line inputs to A2 by performing test procedure for control lines shown In **Table 3E-1**

If any control line measures bad, it is not necessary to test remaining lines; proceed to step **14**.

**Run Test**

1. Switch instrument to Standby:
   - Disconnect cable **W14** from module at **A2J1**.
   - Plug end of **W14** into 20 pin test connector, from On-site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W14P2.**

**CAUTION**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1**). (See **A2 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

3. Turn instrument on.

## Clock and Data Control Lines

### Check High State

4. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify high state.)

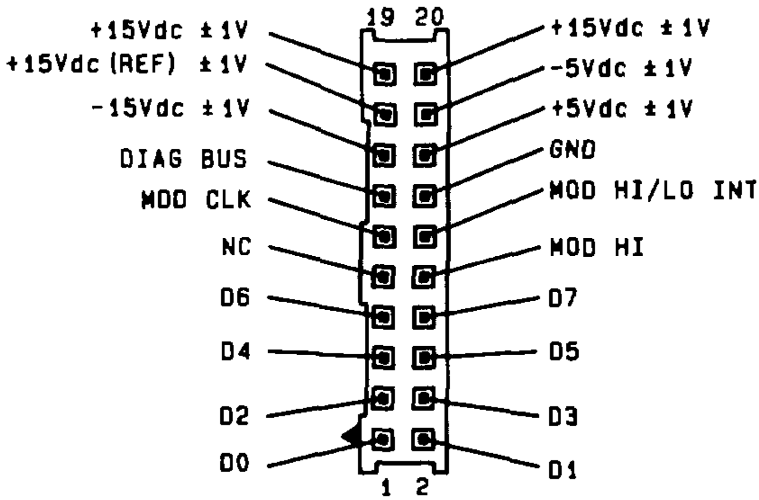
5. Enter Bit Select Keys as indicated in.**Table 3E-1. W14P2 Control Bits**, for Control Line to be tested.

6. Connect **VM** probe Control Line at Pin Number indicated in **Table 3E-1**. (See **Figure 3E-1. Cable Plug W14P2 Signal Locator**.)

**Table 3E-1. W14P2 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 5 and 10) | **Pin Number** (Step 6) |
|---|---|---|---|
| 1 | MOD CLK | [6] [0] [HZ] | 11 |
| 2 | D0 | [4] [8] [HZ] | 1 |
| 3 | D1 | [4] [9] [HZ] | 2 |
| 4 | D2 | [5] [0] [HZ] | 3 |
| 5 | D3 | [5] [1] [HZ] | 4 |
| 6 | D4 | [5] [2] [HZ] | 5 |
| 7 | D5 | [5] [3] [HZ] | 6 |
| 8 | D6 | [5] [4] [HZ] | 7 |
| 9 | D7 | [5] [5] [HZ] | 8 |

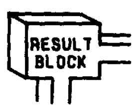
**Figure 3E-1, Cable Plug W14P2 Signal Locator**




7. [2] [5] [HZ]
   (To enable voltmeter.)
8. Voltage should read approximately **+2.5** to **+5.5 Vdc.** ([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify low state.)
10. Enter **Bit Select Keys** as indicated in **Table 3E-1**. **W14P2 Control Bits**, for same **Control Line**.
11. [2] [5] [HZ]
    (To enable voltmeter.)
12. Voltage should read approximately **-0.5** to **+1.5 Vdc.** ([5] [HZ] to repeat measurement.)
13. Repeat procedure for each Control Line shown in **Table 3E-1**.
14. Record test results.
15. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CONTROL BITS**.



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Voltage Measurements | **A2.14** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 6 min. | |


Internal Voltmeter (**VM**) is used to check power supply levels at inputs to **A2 Module**.

**Run Test**

1. Switch instrument to Standby:
   - Disconnect **W14** from **A2** at **A2J1**.
   - Plug end of **W14** into 20 pin test connector, from On-site Service Kit.

**NOTE**

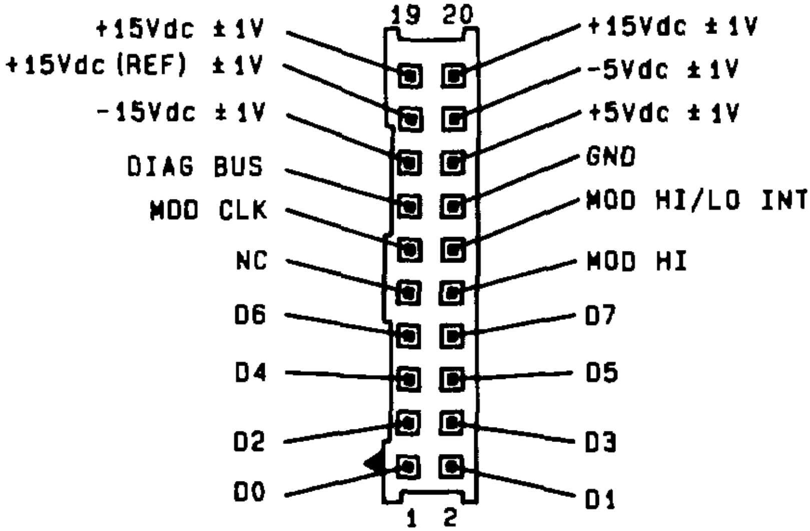
Find arrowhead on test connector and align with arrowhead on cable plug **W14P2**.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1)**. (See **A2 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]'
   (To enable Internal-Voltmeter.)

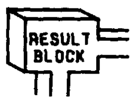
4. Measure voltage levels:
   - Connect **VM** probe to test connector pin for each power supply line (see **Figure 3E-2. Cable Plug W14P2 Signal Locator**).
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3E-2. Cable Plug W14PZ Signal Locator**




5. Record test results.

6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST Vdc**.



## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A2.15** |
| **Run time:** | 5 min. | |
| **Set-up time:** | 1 min. | |


1. Testing has shown cable **W20**, **W21**, **W22**, or **W33** to be defective, temporarily replace with a test cable from the On-Site Service Kit. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

2. Deleted

3. Return to foldout.

## A2 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Check | **A2.16** |
| **Run time:** | N/A | |
| **Set-up time:** | N/A | |


1. Replacement of cable **W14** is not considered an on-site procedure due to extensive disassembly required.

2. To further test **W14**, verify integrity of signal source by proceeding as directed on foldout.

3. Reconnect cable **W14** to **A2 Module**.

4. Return to foldout.

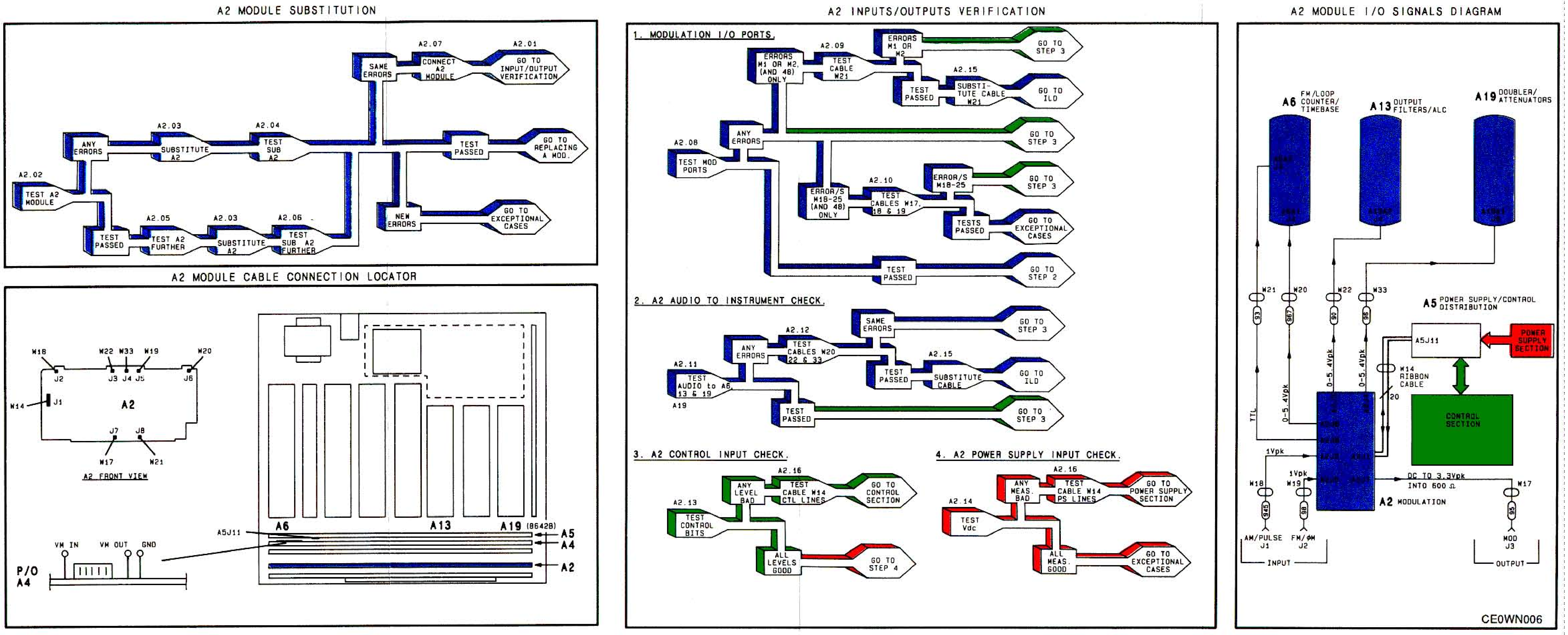



Figure 3E-100. A2 Modulation Module Diagnostics

## A6 FM LOOP/COUNTER/TIMEBASE MODULE

### 3F-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A6 Module**. The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01**, **A03** or **A04**. (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or .74 ft-lbs (slightly tighter than finger tight). When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptible to short circuiting.

**Test Instructions**

1. The instrument's Top Cover must be removed to run many of these tests. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. The last page in this group of tests is a foldout and should be pulled out now.

3. Turn to the next page to begin the **A6 MLD**.

## A6 MODULE SUBSTITUTION

### 3F-2. INTRODUCTION

**NOTE**

If a known good module is not available, proceed to the next page, **A6 INPUTS VERIFICATION**.

The first step in isolating an **A6** failure is to substitute in a known good module from the On-site Service Kit.

**A6 Substitution Instructions**

1. Find **A6 MODULE SUBSTITUTION** on the foldout.

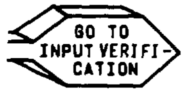
2. Use the Task Sequence Diagram, shown under **A6 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A6 INPUTS VERIFICATION

**A6.01**




### 3F-3. INTRODUCTION

If a known good **A6 Module** is not available, or if you were not able to isolate the failure using the **A6 MODULE SUBSTITUTION** procedure, the Task Sequence Diagrams (shown under **A6 INPUTS VERIFICATION**) should be used to check each signal path into the A6 Module.

**A6 Inputs Verification Instructions**

1. Find **A6 INPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown under **A6 INPUTS VERIFICATION**, are separated into three checks: **Control**, **Power Supply** and **RF** signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under **1. A6 CONTROL INPUT CHECK**.

**NOTE**

The **A6 MODULE I/O SIGNALS DIAGRAM** shows all parts which the **A6 Module** depends on for operation.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Loop Lock/Unlock | **A6.02** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 0 | |


**Run Test**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until "**100.000000MZ  -140.0DM**" appears, to override 20 second reset test.)

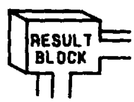
2. [SHIFT] [SPCL] [3] [3] [2] [0] [HZ]

3. When "**DIAG DONE  HIT MSSG .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A6**.  If "**TEST 1 OF A06** (**PASSED** or **FAILED**)" is not displayed, rerun test.

**NOTE**

If any error codes are displayed for modules A01, A03 or A04, you need to isolate those failure(s) before performing the A6 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST A6 MODULE**.



## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A6.03** |
| **Run time:** | 0 | |
| **Set-up time:** | 7 min. | |


The following describes the technique for connecting a known good A6 Module without removing the **A6 Module** in the instrument.

**<u>Connect Substitute Module</u>**

1. Switch instrument to Standby.

2. Disconnect cables **W1**, **W20**, **W21**, **W23**, **W24**, **W26**, **W27**, **W28** and **W29** from **A6 Module** (see **A6 MODULE CABLE CONNECTION LOCATOR** on foldout).

3. Without removing **A6 Module** from instrument carefully lay substitute **A6 Module** on top of modules **A7**, **A9** and **A11**.

**<u>CAUTION</u>**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

4. Connect cables **W1**, **W20**, **W21**, **W23**, **W24**, **W26**, **W27**, **W28** and **W29** to substitute module.

5. Turn instrument on.

6. Return to foldout.

## A6 MODULE DIAGNOSTICS

**Type:** Substitute Module Test **A6.04**
**Run time:** 1 min.
**Set-up time:** 0


Test operation of substitute A6 Module by repeating test performed on **A6 Modul**e before substitution.

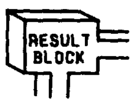
**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000 MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [2] [0] [HZ].

3. When "**DIAG DONE HIT MSSG .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A6**. If "**TEST 1 OF A06** (**PASSED** or **FAILED**)" is not displayed, rerun test.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A6**.



## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A6 Test | **A6.05** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |

The **A6** failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1**: Instrument Level Self Test indicated **A6** failure.
**Condition 2**: RF Power Test for another module indicated **A6** failure.
**Condition 3**: Instrument must be set to a specific operating condition to detect **A6** failure.

### Condition 1

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.

2. [SHIFT] [SPCL] [3] [3] [0] [HZ].

3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to "**FM/FM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue.

4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record **A6** error codes.

**NOTE**

If any error codes are displayed for modules A01, A03 or A04, you need to isolate those failure(s) before performing the A6 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

5. Return to foldout.

**Condition 2**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test,)
2. [SHIFT] [SPCL] [3] [3] [2] [2] [HZ]
3. When "**WAITING FOR SET-UP 1 V24**" appears:
   - Disconnect cable **W28** from module at **A6A2 J8**.
   - Connect **YELLOW PM** cable to module at **A6A2 J8**.
   - [HZ] to continue test.
4. When "**WAITING FOR SET-UP 2 .V25**" appears:
   - Reconnect cable **W28** to module at **A6A2 J8**.
   - Disconnect cable **W26** from module at **A6A2 J6**.
   - Connect **PM** cable to module at **A6A2 J6**.
   - [HZ] to continue test.
5. When "**WAITING FOR SET-UP 3 .V26**" appears:
   - Reconnect cable **W26** to module at **A6A2 J6**.
   - Disconnect cable **W29** from module at **A6A2 J9**.
   - Connect **PM** cable to module at **A6A2 J9**.
   - [HZ] to continue test.
6. When "**WAITING FOR SET-UP 4 .V27**" appears:
   - Reconnect cable **W29** to module at **A6A2 J9**.
   - Disconnect cable **W23** from module at **A6A2 J5**.
   - Connect **PM** cable to module at **A6A2 J5**.
   - [HZ] to continue test.
7. When "**WAITING FOR SET-UP 5 .V28**" appears:
   - Reconnect cable **W23** to module at **A6A2 J5**.
   - Disconnect cable **W24** from module at **A6A1 J2**.
   - Connect **PM** cable to module at **A6A1 J2**.
   - [HZ] to continue test.
8. When "**RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W24** to module at **A6A1 J2**.
   - [HZ] to continue test.
9. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A6**. If "**TEST 2A OF A06** (**PASSED** or **FAILED**)” is not displayed, rerun test.
10. Return to foldout.

## A6 MODULE DIAGNOSTICS

**Condition 3**

1. Set instrument to operating condition which causes **A6** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute A6 Tests | **A6.06** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |


Test operation of substitute A6 Module by repeating test(s) performed on **A6 Module** before substitution.

**Condition 1**: **Instrument Level Self Test** indicated **A6** failure.
**Condition 2**: **RF Power Test** for another module indicated **A6** failure.
**Condition 3**: Instrument must be set to a specific operating condition to detect **A6** failure.

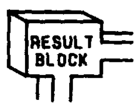
**<u>Condition 1</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].
3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to "**FM/FM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue.
4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record **A6** error codes.

**NOTE**

If any error codes are displayed for modules A01, A03 or A04, you need to isolate those failure(s) now.

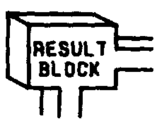
5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each for TEST SUB A6 FURTHER.



## A6 MODULE DIAGNOSTICS

**Condition 2**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ  -140.0DM**" appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [2] [2] HZ].
3. When "**WAITING FOR SET-UP 1  .V24**" appears:
   • Disconnect cable **W28** from module at **A6A2 J8**.
   * Connect **YELLOW PM** cable to module at **A6A2 J8**.
   * [HZ] to continue test.
4. When "**WAITING FOR SET-UP 2  .V25**" appears:
   • Reconnect cable **W28** to module at **A6A2 J8**.
   • Disconnect cable **W26** from module at **A6A2 J6**.
   • Connect **PM** cable to module at **A6A2 J6**.
   • [HZ] to continue test.
5. When "**WAITING FOR SET-UP 3  .V26**" appears:
   • Reconnect cable **W26** to module at **A6A2 J6**.
   • Disconnect cable **W29** from module at **A6A2 J9**.
   • Connect **PM** cable to module at **A6A2 J9**.
   • [HZ] to continue test.
6. When "**WAITING FOR SET-UP 4  .V27**" appears:
   • Reconnect cable **W29** to module at **A6A2 J9**.
   • Disconnect cable **W23** from module at **A6A2 J5**.
   • Connect **PM** cable to module at **A6A2 J5**.
   • [HR] to continue test.
7. When "**WAITING FOR SET-UP 5  .V28**" appears:
   • Reconnect cable **W23** to module at **A6A2 J5**.
   • Disconnect cable **W24** from module at **A6A1 J2**.
   • Connect **PM** cable to module at **A6A1 J2**.
   • [HZ]  to continue test.
8. When "**RECONNECT ALL CABLES  .V29**" appears:
   • Reconnect cable **W24** to module at **A6A1 J2**.
   • [HZ] to continue test.
9. When "**DIAG DONE HIT  MSSGS .V1**" appears:
   • Use [MSSG] to scroll through messages.
   • Record error code(s) displayed for **A6**.  If "**TEST 2A OF A06** (**PASSED** or **FAILED**)" is not displayed, rerun test.)
10. Return to foldout:
    • Determine next task by comparing test results to conditions shown in each for **TEST SUB A6 FURTHER**.

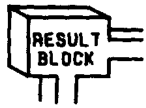


## A6 MODULE DIAGNOSTICS

**Condition 3**

1. Set instrument to operating condition which causes **A6** failure.

2. Record instrument set-up and error message(s).

3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each  for **TEST SUB A6 FURTHER**.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A6.07** |
| **Run time:** | 0 |  |
| **Set-up time:** | 5 min. | |

**Connect Module**

1. Switch instrument to Standby.

2. Disconnect cables **W1, W20, W21 W23, W24, W26, W27, W28** and **W29** from substitute **A6 Module**.

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

3. Reconnect cables **W1, W20, W21, W23, W24, W26, W27, W28** and **W29** to **A6 Module.**

4. Turn instrument on.

5. Return substitute A6 Module to On-Site Service Kit.

6. Return to foldout.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A6.08** |
| **Run time:** | 3 min. |  |
| **Set-up time:** | 2 min. | |

Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A6 Module** on Clock, Data and Control lines.

**NOTE**

If any control line level is bad, it is not necessary to test remaining lines; proceed to step **34**.

**<u>Run Test</u>**

1. Switch instrument to Standby:
   - Disconnect cable **W1** from module at **A6A1 J1**.
   - Plug end of **W1 into 26** pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W1P2.**

**<u>CAUTION</u>**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1)**. (See **A6 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

3. Turn instrument on.

## FM Control Lines

### Check High State

4. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state)

**NOTE**

A "**0**" will appear in display indicating that these data bits will be set low. However, the bits are inverted in the Control Section -before they are sent to A6.

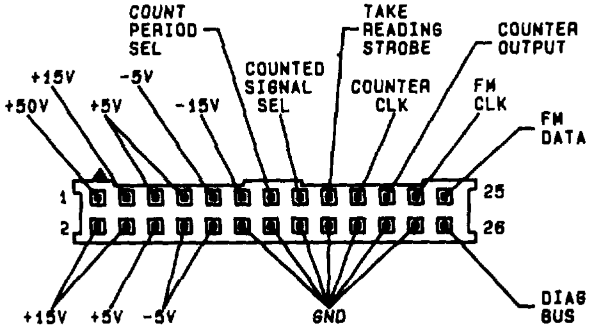
5. Enter **Bit Select Keys**, as indicated in **Table 3F-1. W1P2 Control Bits**, for **Control Line** to be tested.

6. Connect **VM** probe to **Control Line** at **Pin Number** indicated in **Table 3F-1**. (See **Figure 3F-1. Cable Plug W1P2 Signal Locator**.)

**Table 3F-1. W1P2 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 5 and 10) | **Pin Number** (Step 6) |
|---|---|---|---|
| 1 | FM CLK | [4] [6] [HZ] | 23 |
| 2 | FM DATA | [4] [7] [HZ] | 25 |

**Figure 3F-1. Cable Plug W1P2 Signal Locator**



7. [2] [5] [HZ]
(To enable voltmeter.)

8. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [1]
(To specify low state.)

**NOTE**

A "**1**" will appear in display indicating that these data bits will be set high. However, the bits are inverted in the Control Section before they are sent to A6.

10. Enter **Bit Select Keys**, as indicated in **Table 3F-1**, for same **Control Line**.

11. [2] [5] [HZ]
(To enable voltmeter.)

12. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
([5] [HZ] to repeat measurement.)

13. Repeat procedure for each **Control Line** shown in **Table 3F-1** before proceeding to step **14**.

**Counter Control Lines**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [1]
(To specify high state.)

15. Enter **Bit Select Keys**, as indicated in **Table 3F-2. W1P2 Control Bits**, for **Control Line** to be tested.

16. Connect **VM** probe to **Control Line** at **Pin Number** indicated in **Table 3F-2**. (See **Figure 3F-1**. **Cable Plug W1P2 Signal Locator**.)

**Table 3F-2. W1P2 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 15 and 20) | **Pin Number** (Step 16) |
|---|---|---|---|
| 1 | COUNTER CLK | [7] [2] [HZ] | 19 |
| 2 | TAKE READING STROBE | [7] [3] [HZ] | 17 |
| 3 | COUNT PERIOD SELECT | [7] [4] [HZ] | 13 |
| 4 | COUNTED SIGNAL SELECT | [7] [5] [HZ] | 15 |

17. [2] [5] [HZ]
(To enable voltmeter.)

18. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify low state.)

20. Enter **Bit Select Keys**, as indicated in **Table 3F-2**, for same **Control Line**.

21. [2] [5] [HZ]
(To enable voltmeter.)

22. Voltage should read approximately **-0.5 to +1.5 Vdc**.
([5] [HZ] to repeat measurement.)

23. Repeat procedure for each **Control Line** shown in **Table 3F-2** before proceeding to step **24**.

## A6 MODULE DIAGNOSTICS

24. Switch instrument to Standby:
    - Disconnect **W1** from module at **A6A2 J1**.
    - Plug end of **W1** into **14** pin test connector, from On-Site Service Kit, into end of **W1**. (See **Figure 3F-2**. **Cable Plug W1P3 Signal Locator**.)

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W1P3.**

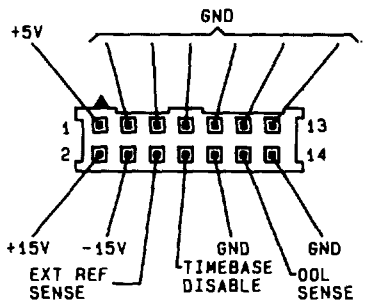
- Turn instrument on.

**Timebase Control Line**

**Check High State**

25. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify high state.)
26. [1] [4] [HZ]
    (To select bit.)
27. Connect **VM** probe to test connector at **TIMEBASE DISABLE** (pin **8**). (See **Figure 3F-2**. **Cable Plug W1P3 Signal Locator**.)

**Figure 3F-2. Cable Plug W1P3 Signal Locator**




28. [2] [5] [HZ]
    (To enable voltmeter.)
29. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

## Check Low State

30. [SHIFT] [SPCL] (30 [6] [0] [2]
    (To specify low state.)

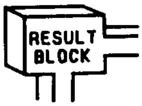
31. [1] [4] [HZ]
    (To select bit.)

32. [2] [5] [HZ]
    (To enable voltmeter.)

33. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

34. Record test results.

35. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each




for **TEST CONTROL BITS**.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A6.09** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |


Internal Voltmeter **(VM)** is used to measure **TTL** level changes transmitted to **A6 Module** on Clock, Data and Control lines.

**<u>Run Test</u>**

1. Switch instrument to **Standby**.

2. Extend **A6 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W1** from **A5 Module** at **A5J1**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate **A6 Module** extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W1**.

3. Connect **VM** probe:
   - Connect red alligator clip and **pointed tip** probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1)**. (See **A6 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

4. Turn instrument on.

**NOTE**

It is only necessary to perform test on failing control line.

## FM Control Lines

### Check High State

5. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify high state.)

**NOTE**

A "**0**" will appear in display indicating that these data bits will be set low. However, the bits are inverted in the Control Section before they are sent to **A6**.

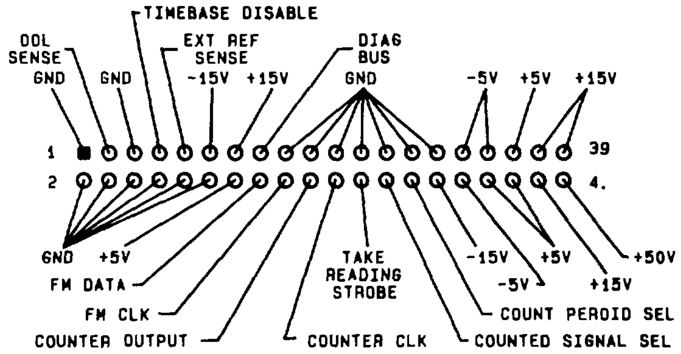
6. Enter **Bit Select Keys**, as indicated in **Table 3F-3**. **A5J1 Control Bits**, for **Control Line** to be tested.

7. Connect **VM** probe to **Control Line** at **Pin Number** indicated in **Table 3F-3**. (See **Figure 3F-3. A5J1 Signal Locator**.)

**Table 3F-3. A5J1 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 6 and 11) | **Pin Number** (Step 7) |
|---|---|---|---|
| 1 | FM CLK | [4] [6] [HZ] | 18 |
| 2 | FM DATA | [4] [7] [HZ] | 16 |

**Figure 3F-3. A5J1 Signal Locator**
**(Solder-Side View)**



8. [2] [5] [HZ]
   (To enable voltmeter.)

9. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
   ([5] [HZ] to repeat measurement.)

**Check Low State**

10. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)

**NOTE**

A "**1**" will appear in display indicating that these data bits will be set high. However, the bits are inverted in the Control Section before they are sent to **A6.**

11. Enter **Bit Select Keys**, as indicated in **Table 3F-3**, for same **Control Line**.

12. [2] [5] [HZ]
    (To enable voltmeter.)

13. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

**Counter/Timebase Control Lines**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify high state.)

15. Enter **Bit Select Keys**, as indicated in **Table 3F-4. A5J1 Control Bits**, for **Control Line** to be tested.

16. Connect **VM** probe to Control Line at Pin Number indicated in **Table 3F-4**. (See **Figure 3F-3. A5J1 Signal Locator**.)

**Table 3F-4. A5J1 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 15 and 20) | **Pin Number** (Step 16) |
|---|---|---|---|
| 1 | COUNTER CLK | [7] [2] [HZ] | 22 |
| 2 | TAKE READING STROBE | [7] [3] [HZ] | 24 |
| 3 | COUNT PERIOD SELECT | [7] [4] [HZ] | 28 |
| 4 | COUNTED SIGNAL SELECT | [7] [5] [HZ] | 26 |
| 5 | TIMEBASE DISABLE | [1] [4] [HZ] | 7 |

17. [2] [5] [HZ]
(To enable voltmeter.)

18. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify low state.)

20. Enter **Bit Select Keys**, as indicated in **Table 3F-4**, for same **Control Line**.

## A6 MODULE DIAGNOSTICS

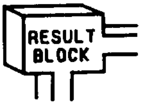
21. [2] [5] [HZ]
    (To enable voltmeter.)

22. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

23. Repeat procedure for each Control Line shown in **Table 3F-4**.

24. Record test results.

25. Reconnect **W1** and lower **Module** back into instrument.

26. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each 

for **TEST CABLE W1 CTL LINES**.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A6.10** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter (**VM**) is used to check power supply levels at inputs to **A6 Module**.

**Run Test**

1. Switch instrument to Standby:
   - Disconnect **W1** from **A6** at **A6A1J1**.
   - Plug end of **W1** into **26** pin test connector, from On-Site Service Kit.

**NOTE**

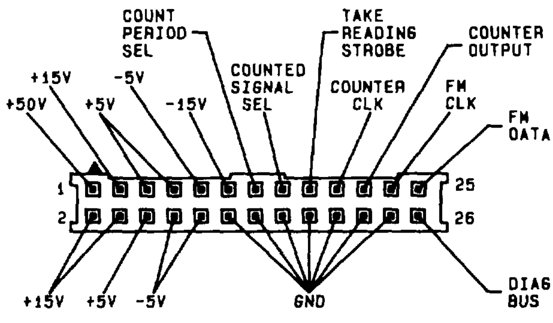
Find arrowhead on test connector and align with arrowhead on cable plug **W1P2**.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A6 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

4. Measure voltage levels:
   - Connect **VM** probe to test connector pin for each power supply line. (See **Figure 3F-3. Cable Plug W1P2 Signal Locator**.)
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3F-3. Cable Plug W1P2 Signal Locator**



## A6 MODULE DIAGNOSTICS

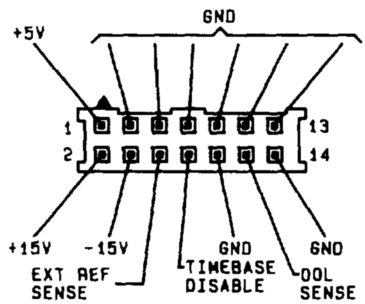
5. Switch instrument to Standby:
   - Disconnect **W1** from **A6** at **A6A2J1**.
   - Plug end of **W1** into **14 pin** test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W1P3.**

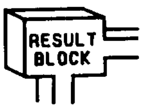
6. Measure voltage levels:
   - Connect **VM** probe to test connector pin for each power supply line. (See **Figure 3F-4. Cable Plug W1P3 Signal Locator**.)
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3F-4. Cable Plug W1P3 Signal Locator**




7. Record test results.

8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each




for **TEST Vdc**.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A6.11** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 3 min. | |

Internal Voltmeter (**VM**) is used to check power supply levels at **A5J1**.

**<u>Run Test</u>**

1. Switch instrument to **Standby**.

2. Extend **A6 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W1** from **A5 Module** at **A5J1**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate **A6 Module** extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W1.**

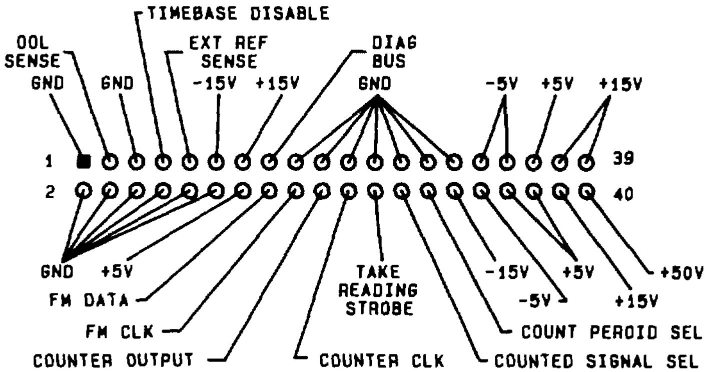
3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit. -
   - Connect alligator clip to **VM IN (A4TP1).** (See **A6 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

4. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

## A6 MODULE DIAGNOSTICS

5. Measure voltage levels at **A5J1**:
   - Access signals from solder-side of **A5J1**. (See **Figure 3F-5. A5J1 Signal Locator**.)
   - [5] [HZ] (To make each voltage measurement.)

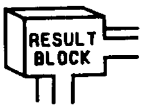
**Figure 3F-5. A5J1 Signal Locator**
**(Solder-Side View)**




6. Record test results.

7. Reconnect **W1** and lower **Module** back into instrument.

8. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each




for **TEST CABLE W1 PS LINES**.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | External Reference Check | **A6.12** |
| **Run Time:** | 10 sec. |  |
| **Set-up Time:** | 0 | |

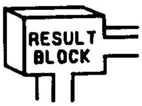
### Run Test

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ   -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [5] (9) [HZ]

3. Record test results.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each

     
     
     for **TEST EXT. REF**.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Loop Lock/Unlock | **A6.13** |
| **Run Time:** | 1 min. |  |
| **Set-up Time:** | 0 | |



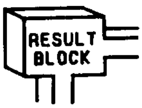
**Run Test**

1. Disconnect external reference from Rear Panel at **EXT REF INPUT** (**J4**)**.**

2. [INSTR PRESET] [SHIFT]
(Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

3. [SHIFT] [SPCL] [3] [3] [2] [0] [HZ].

4. When **"DIAG DONE HIT MSSG .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A6**. If **"TEST 1 OF A06** (**PASSED** or **FAILED**)**"** is not displayed, rerun test.

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

for **TEST LOOP**.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | External Reference | **A6.14** |
| **Run time:** | N/A |  |
| **Set-up time:** | N/A | |

Test results indicate that the external reference signal is not stable enough for the **A6 Module** to lock to.

1. Use another reference source if available or operate instrument unreferenced.

2. Return to foldout and proceed as directed to confirm correct operation of the rest of instrument.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A6.15** |
| **Run time:** | 0 min. |  |
| **Set-up time:** | 4 min. | |

Testing has shown cable **W1** to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

**NOTE**

Cable **W1** is a single cable which splits and connects both **A6A1 J1** and **A6A2 J1** to **A5J1**.

**CAUTION**

When connecting ribbon cable to A6 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W1**

1. Switch instrument to **Standby** to connect cable **W1** to **A5 Module** and **A6** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on connecting cable **W1** to **A5J1**.)

2. Return to foldout.

## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A6.16** |
| **Run time:** | O min. |  |
| **Set-up time:** | 4 min. | |

**CAUTION**

When connecting ribbon cable to A6 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W1**

1. Switch instrument to **Standby** to reconnect cable **W1** to **A5 Module** or **A6 Module**. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on reconnecting cable **W1** to **A5J1**.)

2. Return to foldout.

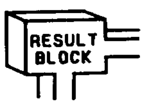
## A6 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A6-17** |
| **Run time:** | 30 sec. |  |
| **Set-up time:** | 3 min. | |

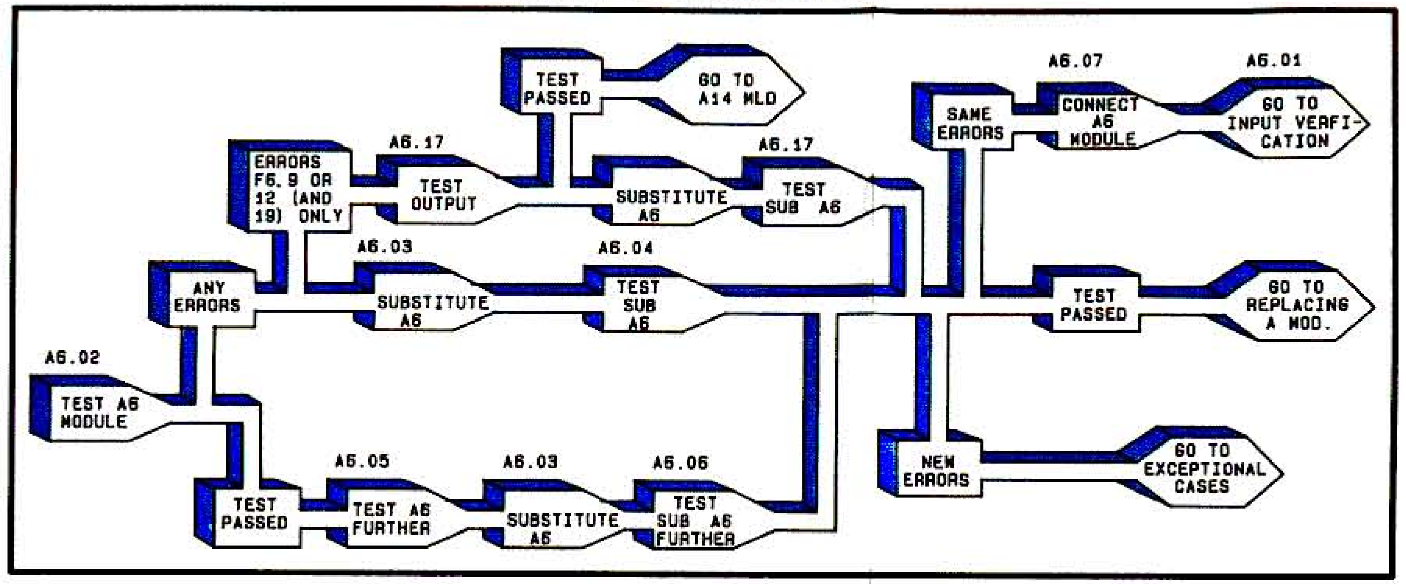
RF signal level is measured using Internal Power Meter (**PM**).

**Run Test**

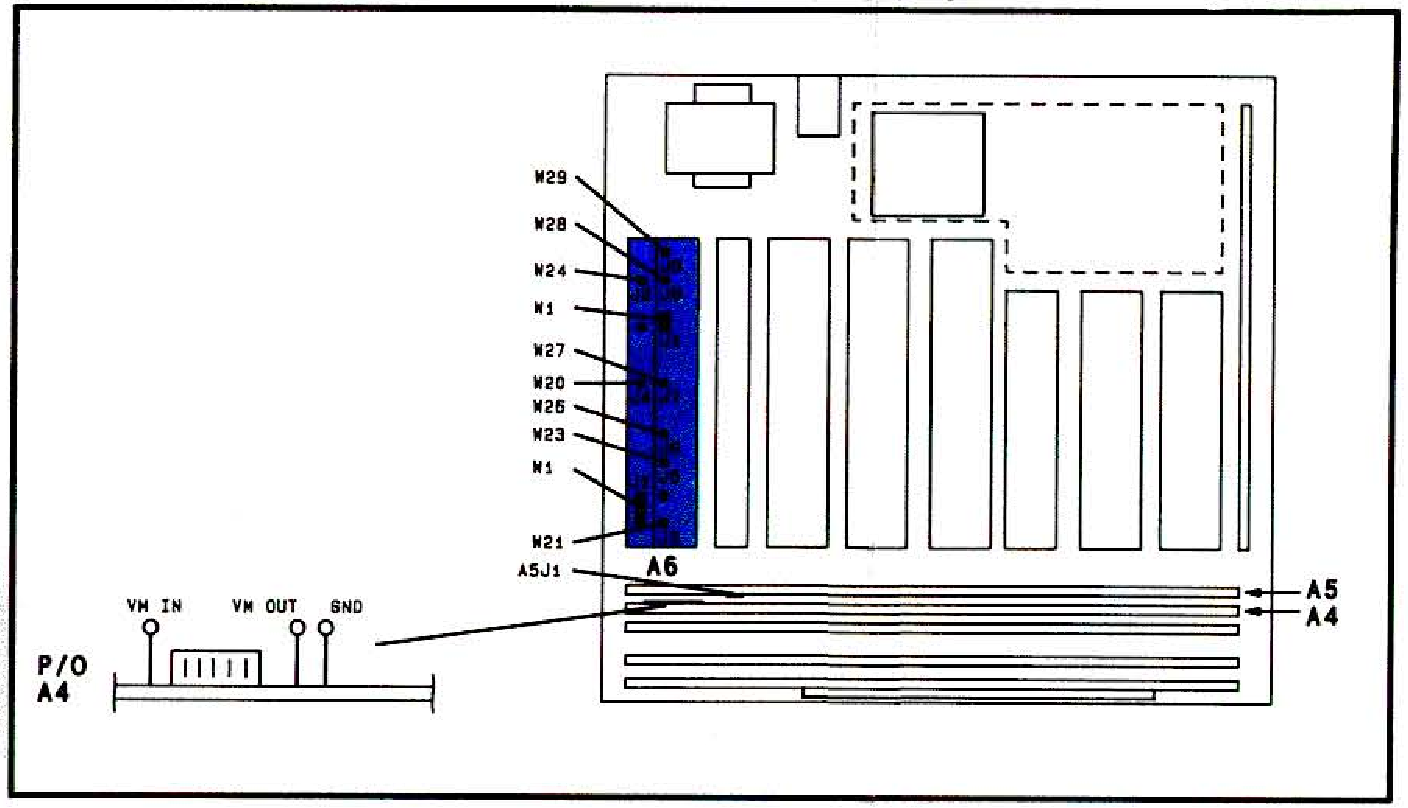
1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ   -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] (8) [1] [4] [HZ]
   (To check input levels only.)
3. [3] [2] [2] [HZ]
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable W28 from **A6** module at **A6A2 J8**.
   - Connect YELLOW PM cable to **A6** module at **A6A2 J8**.
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 2 .V25"** appears
   - Reconnect cable W28 to module at **A6A2 J8**.
   - Disconnect cable W26 from module at **A6A2 J6**.
   - Connect PM cable to module at **A6A2 J6**.
   - [HZ] to continue test.
6. When **"WAITING FOR SET-UP 3 .V26"** appears:
   - Reconnect cable W26 to module at **A6A2 J6**.
   - Disconnect cable W29 from module at **A6A2 J9**.
   - Connect PM cable to module at **A6AZ J9**.
   - [HZ] to continue test.
7. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable W29 to A6 module at **A6A2 J9**.
   - [HZ] to continue test.
8. When **"DIAG DONE HIT MSSGS .V1"** appears
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A6**.
9. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each

     
     
     for **TEST OUTPUT**.

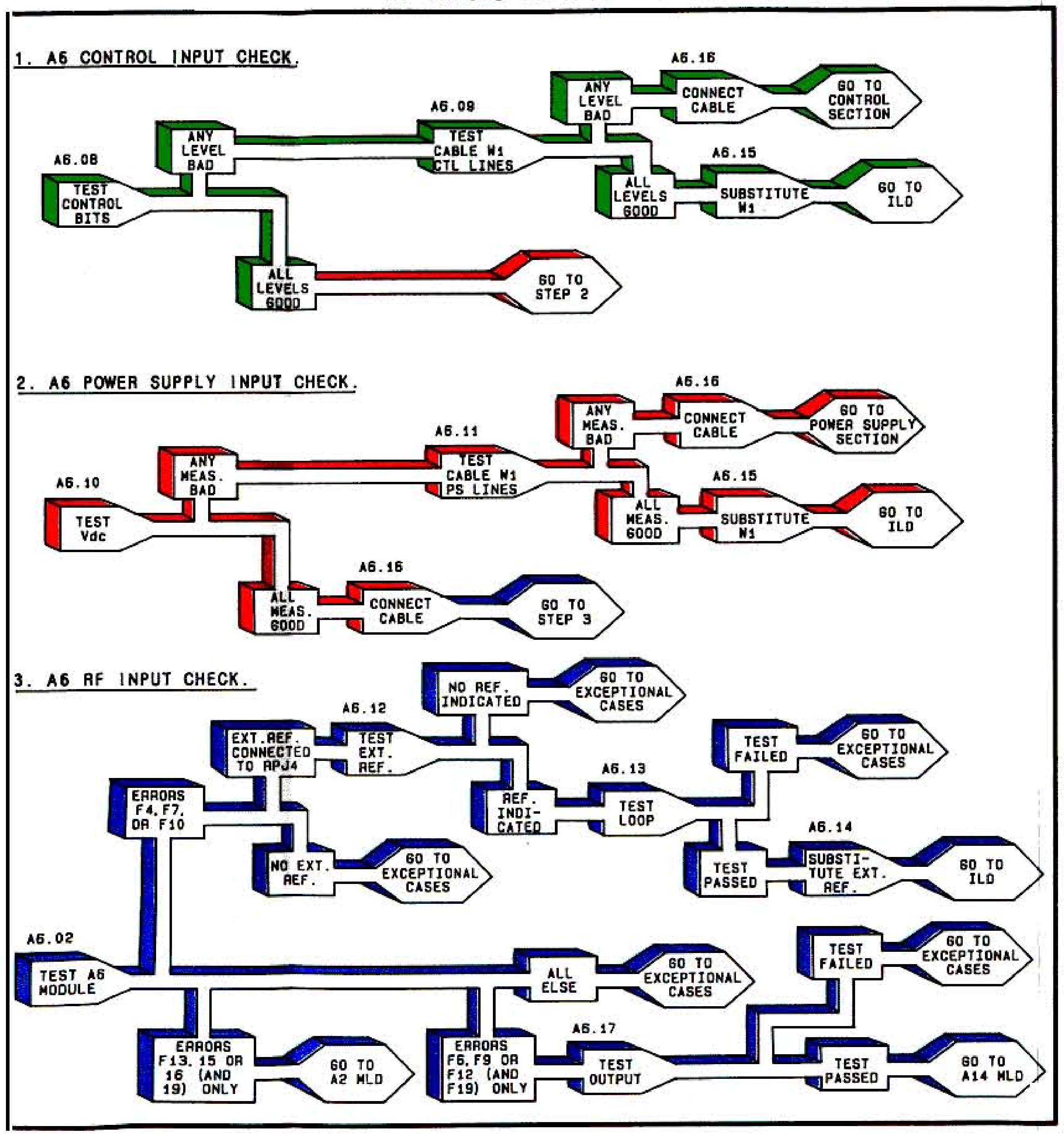
A6 MODULE SUBSTITUTION




A6 MODULE CABLE CONNECTION LOCATOR




A6 INPUTS VERIFICATION




A6 MODULE I/O SIGNALS DIAGRAM

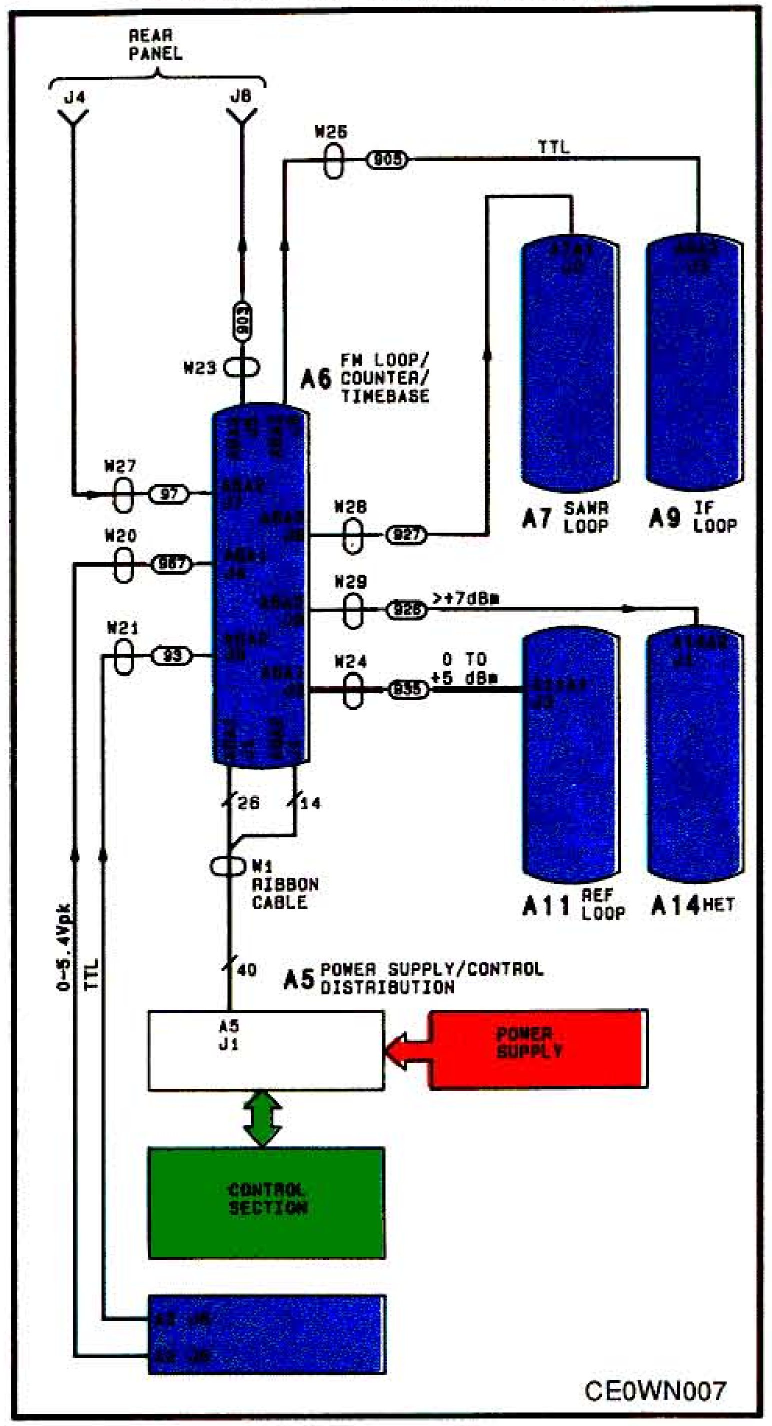



Figure 3F-100. A6 FM Loop/Counter/Timebase Module Diagnostics.

## A7 SAWR LOOP MODULE

### 3G-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A7 Module**. The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01 - A06**. (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or .74 ft-lbs (slightly tighter than finger tight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptable to short circuiting.

**Test Instructions**

1. The instrument's **Top Cover** must be removed to run many of these tests. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. **The last page in this group of tests is a foldout and should be pulled out now**.

3. Turn to the next page to begin the **A7 MLD**.

## A7 MODULE SUBSTITUTION

### 3G-2. INTRODUCTION

**NOTE**

If a known good module is not available, proceed to the next page, **A7 INPUTS VERIFICATION**.

The first step in isolating an **A7** failure is to substitute in a known good module from the On-site Service Kit.

**A7 Substitution Instructions**

1. Find **A7 MODULE SUBSTITUTION** on the foldout.

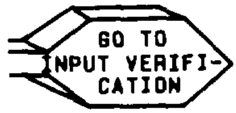
2. Use the Task Sequence Diagram, shown under **A7 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A7 INPUTS VERIFICATION

A7.01




### 3G-3. INTRODUCTION

If a known good **A7 Module** is not available or if you were not able to isolate the failure using the **A7 MODULE SUBSTITUTION** procedure the Task Sequence Diagrams (shown under **A7 INPUTS VERIFICATION**) should be used to check each signal path into the **A7 Module**.

**A7 Inputs Verification Instructions**

1. Find **A7 INPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown under **A7 INPUTS VERIFICATION**, are separated into three checks: **RF, Control** and **Power Supply** signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under **1. A7 RF INPUT CHECK**.

**NOTE**

The **A7 MODULE I/O SIGNALS DIAGRAM** shows all parts which the **A7 Module** depends on for operation.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Loop Lock/Unlock | **A7.02** |
| **Run time:** | 1 min. |   |
| **Set-up time:** | 0 | |

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ   -140.0DM"** appears, to override 20 second reset test.)

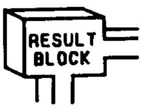
2. [SHIFT] [SPCL] [3] [3] [2] [5] [HZ].

3. When **"DIAG DONE HIT MSSG .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for A7. If **"TEST 1 OF A07** (**PASSED** or **FAILED**)**"** is not displayed, rerun test.

**NOTE**

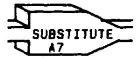
If any error codes are displayed for modules A01 - A06, you need to isolate those failure(s) before performing the A7 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each




for **TEST A7 MODULE**.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A7.03** |
| **Run time:** | 0 |  |
| **Set-up time:** | 5 min. | |

The following describes the technique for connecting a known good A7 Module without removing the A7 module in the instrument.

**Connect Substitute Module**

1. Switch instrument to **Standby**.

2. Disconnect cables **W2, W25** and **W28** from **A7 Module** (see **A7 MODULE CABLE CONNECTION LOCATOR** on foldout).

3. Without removing **A7 Module** from instrument, carefully lay substitute **A7 Module** on top of modules **A9, A11** and **A12**.

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

4. Connect cables **W2, W25** and **W28** to substitute module.

5. Turn instrument on.

6. Return to foldout.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A7.04** |
| **Run time:** | 1 min. |  |
| **Set-up time:** | 0 | |

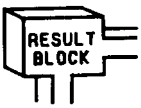
Test operation of substitute A7 Module by repeating test performed on A7 Module before substitution.

**<u>Run Test</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [2] [5] [HZ].

3. When **"DIAG DONE HIT MSSG .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A7**. If **"TEST 1 OF A07 (PASSED or FAILED)"** is not displayed, rerun test.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each
     
     
     for **TEST SUB A7**.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A7 Tests | **A7.05** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |


**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

The A7 failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1:** **Instrument Level Self Test** indicated **A7** failure.

**Condition 2:** **A11 Module RF Power Test** indicated **A7** failure.

**Condition 3:** Instrument must be set to a specific operating condition to detect **A7** failure**.**

**Condition 1**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Connect BNC Tee connector from On-Site Service Kit, to **"FM/FM INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.
4. When **"DIAG DONE HIT MSSGS .VI"** appears:
   - Use [MSSG] to scroll through messages.
   - Record A7 error codes.

**NOTE**

If any error codes are displayed for modules A01-A06, you need to isolate those failure(s) before performing the A7 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

5. Return to foldout.

## A7 MODULE DIAGNOSTICS

**Condition 2**

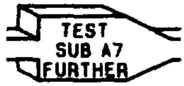
1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000 MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [2] [6] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W28** from module at **A7A1 J2**.
   - Connect **YELLOW PM** cable and adapter to cable **W28**.
   - [HZ] to continue test.
4. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W28** to module at **A7A1 J2**.
   - Disconnect cable **W25** from module at **A7A1 J3**.
   - Connect PM cable to module at **A7A1 J3**.
   - [HZ] to continue test.
5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W25** to module at **A7A1 J3**.
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS.V1"** appears:
   - Use [ MSSG j to scroll through messages.
   - Record error code(s) displayed for **A7**. If "**TEST 2A OF A07** (**PASSED** or **FAILED**)" is not displayed, rerun test.
7. Return to foldout.

**Condition 3**

1. Set instrument to operating condition which causes **A7** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute A7 Tests | **A7.06** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |




**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

Test operation of substitute A7 Module by repeating test(s) performed on A7 Module before substitution.

**Condition 1:** **Instrument Level Self Test** indicated **A7** failure.

**Condition 2:** **All Module RF Power Test** indicated **A7** failure.

**Condition 3:** Instrument must be set to a specific operating condition to detect **A7** failure.

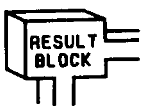
**Condition 1**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Connect BNC Tee connector from On-Site Service Kit, to **"FM/FM INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.
4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record A7 error codes.

**NOTE**

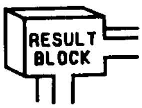
If any error codes are displayed for modules A01 - A06, you need to isolate those failure(s) now.

5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each



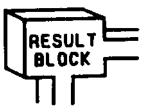

for **TEST SUB A7 FURTHER**.

**Condition 2**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [2] [6] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W28** from module at **A7A1 J2**.
   - Connect **YELLOW PM** cable and adapter to cable **W28**.
   - [HZ] to continue test.
4. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W28** to module at **A7A1 J2**.
   - Disconnect cable **W25** from module at **A7A1 J3**.
   - Connect **PM** cable to module at **A7A1 J3**.
   - [HZ] to continue test.
5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W25** to module at **A7A1 J3**.
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A7**. If "**TEST 2A OF A7** (**PASSED** or **FAILED**)" is not displayed, rerun test.)
7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST SUB A7 FURTHER**.

**Condition 3**

1. Set instrument to operating condition which causes **A7** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST SUB A7 FURTHER**.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A7.07** |
| **Run time:** | 0 |  |
| **Set-up time:** | 5 min. | |

### Connect Module

1. Switch instrument to **Standby**.

2. Disconnect cables **W2, W25** and **W28** from substitute **A7 Module**.

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

3. Reconnect cables **W2, W25** and **W28** to **A7 Module**.

4. Turn instrument on.

5. Return substitute A7 Module to On-Site Service Kit.

6. Return to foldout.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A7.08** |
| **Run time:** | 30 sec. |  |
| **Set-up time:** | 2 min. | |

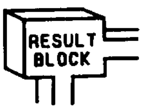
RF signal level is measured using Internal Power Meter (**PM**).

**CAUTION**

Do not permit end of Internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] (8) [1] [2] [HZ]
   (To check Input levels only)
3. [3] [2] [6] [HZ].
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W28** from module at **A7A1 J2**.
   - Connect **YELLOW PM** cable and adapter to cable **W28**.
   - [HZ] to continue test.
5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W28** to module at **A7A1 J2**.
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A7**. If **"TEST 2A OF A07** (**PASSED** or **FAILED**)" is not displayed, rerun test.
7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each



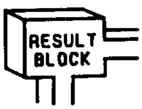
for **TEST RF POWER**.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A7.09** |
| **Run time:** | 30 sec. |  |
| **Set-up time:** | 2 min. | |

RF signal level is measured using Internal Power Meter (**PM**).

**<u>Run Test</u>**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.0000000M -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] (8) [1] [2] [HZ]
   (To check input levels only.)
3. [3] [2] [6] [HZ]
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W28** from module at **A6A2 J8**. (See Top View Diagram inside **Top Cover** to locate **W28** connection on **A6 Module**.)
   - Connect **YELLOW PM** cable to module at **A6A2 J8**.
   - [HZ] to continue test.
5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W28** to module at **A6A2 J8**.
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A7**. If "**TEST 2A OF A07** (**PASSED** or **FAILED**)" is not displayed, rerun test.
7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each  for **TEST CABLE W28**.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A7.10** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter (**VM**) is used to measure TTL level changes transmitted to **A7 Module** on SAWR oscillator select lines **A** and **B**.

**<u>Run Test</u>**

1. Switch instrument to **Standby**:
   - Disconnect cable **W2** from module at **A7A1 J1**.
   - Plug end of **W2** **<u>into</u>** **14** pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W2P2.**

**<u>CAUTION</u>**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A7 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)
3. Turn instrument on.
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

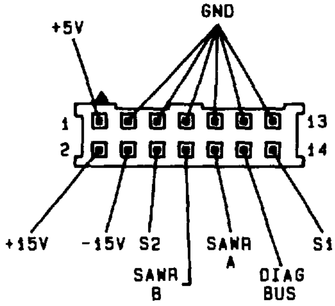
**<u>SAWR Select Line A</u>**

**Check High State**

4. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify high state.)
5. [3] [0] [HZ]
   (To select bit.)

6. Connect **VM** probe to test connector line **A** (pin **10**). (See **Figure 3G-1. Cable Plug W2P2 Signal Locator**.)

**Figure 3G-1. Cable Plug W2P2 Signal Locator**




7. [2] [5] [HZ]
(To enable voltmeter.)

8. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [2]
To specify low state.)

10. [3] [0] [HZ]
(To select bit.)

11. [2] [5] [HZ]
(To enable voltmeter.)

12. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
([5] [HZ] to repeat measurement.)

**SAWR Select Line B**

**Check High State**

13. [SHIFT] [SPCL] [3] [6] [0] [1]
(To specify high state.)

14. [3] [1] [HZ]
(To select bit.)

15. Connect **VM** probe to test connector line **B** (pin **8**). (See **Figure 3G-1. Cable Plug W2P2 Signal Locator**.)

16. [2] [5] [HZ]
(To enable voltmeter.)

17. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Check Low State**

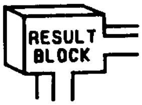
18. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify low state.)

19. [3] [1] [HZ]
(To select bit.)

20. [2] [5] [HZ]
(To enable voltmeter.)

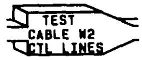
21. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
([5] [HZ] to repeat measurement.)

22. Record test results.

23. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

 for **TEST CONTROL BITS.**

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A7.11** |
| **Run time:** | 3 min. |  |
| **Set-up time:** | 3 min. | |

Internal Voltmeter (**VM**) is used to measure TTL level changes transmitted to **A7 Module** on SAWR oscillator select lines **A** and **B**.

**<u>Run Test</u>**

1. Switch instrument to Standby.

2. Extend **A7 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W2** from **A5** Assembly at **A5J2**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate **A7 Module** extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable W2.

3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A7 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

4. Turn instrument on.

**<u>SAWR Select Line A</u>**

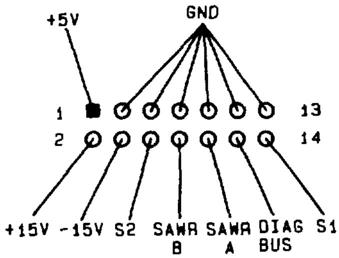
**Check High State**

5. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify high state.)

6. [3] [0] [HZ]
   (To select bit.)

7. Connect **VM** probe to solder-side of **A5J2** line **A** (pin **10**). (See **Figure 3G-2. ASJ2 Signal Locator**.)

**Figure 3G-2. A5J2 Signal Locator (Solder-Side View)**




8. [2] [5] [HZ]
(To enable voltmeter.)

9. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Check Low State**

10. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify low state.)

11. [3] [0] [HZ]
(To select bit.)

12. [2] [5] [HZ]
(To enable voltmeter.)

13. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
([5] [HZ] to repeat measurement.)

**SAWR Select Line B**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [1]
(To specify high state.)

15. [3] [1] [HZ]
(To select bit.)

16. Connect **VM** probe to solder-side of **A5J2** line **B** (pin **8**).
**(See Figure 3G-2. A5J2 Signal Locator.)**

17. [2] [5] [HZ]
(To enable voltmeter.)

18. Voltage should read approximately **+2.5 to +5.5** Vdc.
[5] [HZ] to repeat measurement.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify low state.)

20. [3] [1] [HZ]
(To select bit.)

21. [2] [5] [HZ]
(To enable voltmeter.)

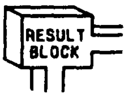
22. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
[5] [HZ] to repeat measurement.)

23. Record test results.

24. Reconnect **W2** and lower **Module** back into instrument.

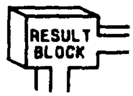
25. Return to foldout:

- Determine next task by comparing test results to conditions shown in each for **TEST CABLE W2 CTL LINES**.



## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A7.12** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 2 min. | |




Internal Voltmeter **(VM)** is used to check power supply levels at inputs to **A7 Module**.

**Run Test**

1. Switch instrument to **Standby**:
   - Disconnect **W2** from **A7** at **A7A1 J1**.
   - Plug end of **W2** **into** **14 pin** test connector, from On-Site Service Kit.

**NOTE**

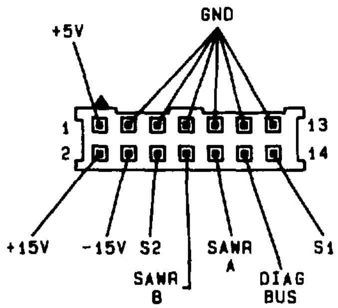
Find arrowhead on test connector and align with arrowhead on cable plug **W2P2.**

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A7 MODULE CABLE CONNECTION LOCATOR** on fold- out for **VM IN** location.)

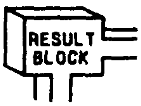
3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

4. Measure voltage levels:
   - Connect **VM** probe to test connector pin for each power supply line (see **Figure 3G-3. Cable Plug W2P2 Signal Locator).**
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3G-3. Cable Plug W2P2 Signal Locator**




5. Record test results.
6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST Vdc.**



## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A7.13** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 3 min. | |


Internal Voltmeter **(VM)** is used to check power supply levels at **A5J2.**

**<u>Run Test</u>**

1. Switch instrument to **Standby**.

2. Extend **A7 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W2** from **A5** Assembly at **A5J2**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate **A7 Module** extension and A5 cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W2.**

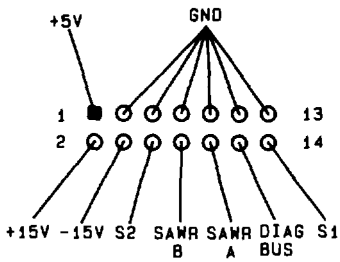
3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A7 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

4. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

## A7 MODULE DIAGNOSTICS

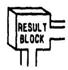
5. Measure voltage levels at **A5J2:**
   - Access signals from solder-side of **A5J2**. (See **Figure 3G-4**. **A5J2 Signal Locator.)**
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3G-4. A5J2 Signal Locator**
(Solder-Side View)




6. Record test results.

7. Reconnect **W2** and lower **Module** back into instrument.

8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

for **TEST CABLE W2 PS LINES.**

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A7.14** |
| **Run Time:** | 5 min. | |
| **Set-up Time:** | 1 min. | |

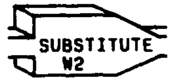

1. Testing has shown cable W28 to be suspect, temporarily replace with a test cable from the On-Site Service Kit. **Rerun INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

2. Deleted.

3. Return to foldout.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A7.15** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 3 min. | |




Testing has shown cable WZ to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

**CAUTION**

When connecting ribbon cable to A7 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W2**

1. Switch instrument to Standby to connect cable **W2** to **A5** Assembly and **A7** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on connecting cable **W2** to **A5J2**.)

2. Return to foldout.

## A7 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A7.16** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 3 min. | |


**CAUTION**

When connecting ribbon cable to A7 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W2**

1. Switch instrument to Standby to reconnect cable **W2** to **A5** Assembly or **A7** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on reconnecting cable **W2** to **A5J2**.)

2. Return to foldout.

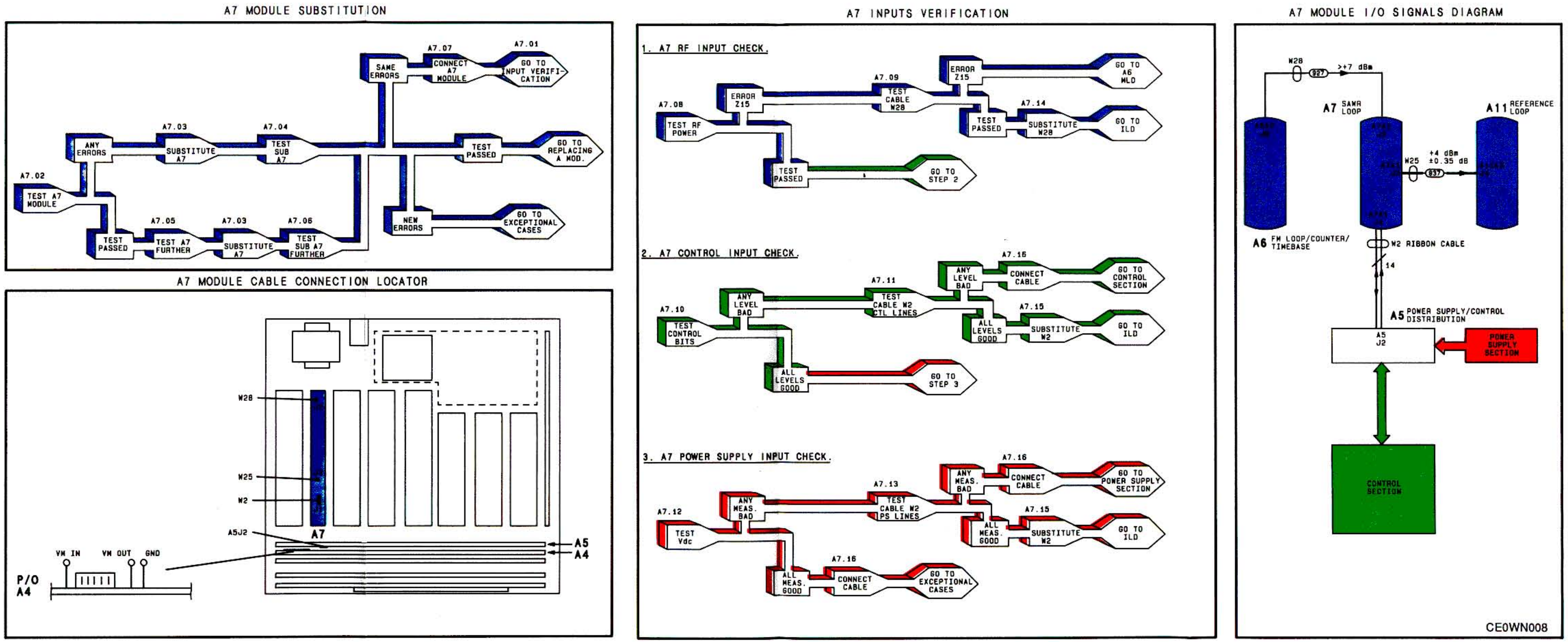



Figure 3G-100. A7 SAWR Loop Module Diagnostics.

## A9 IF LOOP MODULE

### 3H-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the A9 Module. The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01 - A07**. (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or .74 ft-lbs (slightly tighter than finger tight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptible to short circuiting.

**Test Instructions**

1. The instrument's **Top Cover** must be removed to run many of these tests. (Refer to the table shown on the foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. **The last page in this group of tests is a foldout and should be pulled out now**.

3. Turn to the next page to begin the **A9 MLD**.

## A9 MODULE SUBSTITUTION

### 3H-2. INTRODUCTION

**NOTE**

If a known good module is not available, proceed to the next page, **A9 INPUTS VERIFICATION**.

The first step in isolating an **A9** failure is to substitute in a known good module from file On-Site Service Kit.

**A9 Substitution Instructions**

1. Find **A9 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A9 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

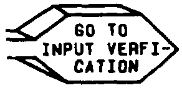
3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A9 INPUTS VERIFICATION

A9.01

### 3H-3. INTRODUCTION




If a known good **A9 Module** is not available, or if you were not able to isolate the failure using the **A9 MODULE SUBSTITUTION** procedure, the Task Sequence Diagrams, shown under **A9 INPUTS VERIFICATION**, should be used to check each signal path into the A9 Module.

<u>**A9 Inputs Verification Instructions**</u>

1. Find **A9 INPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown under **A9 INPUTS VERIFICATION**, are separated into three checks: **RF**, **Control** and **Power Supply** signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the page indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under **1. A9 RF INPUT CHECK.**

**NOTE**

The **A9 MODULE I/O SIGNALS DIAGRAM** shows all parts which the **A9 Module** depends on for operation.

## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Loop Lock/Unlock | **A9.02** |
| **Run time:** | 2 min. 40 sec. | |
| **Set-up time:** | 0 | |


### Run Test

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)

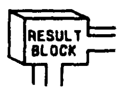
2. [SHIFT] [SPCL] [3] [3] [3] [5] [HZ].

3. When **"DIAG DONE HIT MSSG .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for A9.

**NOTE**

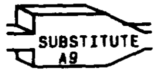
If any error codes are displayed for modules A01 - A07, you need to isolate those failure(s) before performing the A9 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST A9 MODULE.**



## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A9.03** |
| **Run time:** | 0 | |
| **Set-up time:** | 5 min. | |




The following describes the technique for connecting a known good A9 Module **without removing** the A9 Module in the instrument.

### Connect Substitute Module

1. Switch instrument to **Standby**.

2. Disconnect cables **W3, W26** and **W30** from **A9 Module** (see **A9 MODULE CABLE CONNECTION LOCATOR** on foldout).

3. Without removing **A9 Module** from instrument, carefully lay substitute **A9 Module** on top of modules **A11, A12** and **A13.**

**CAUTION**
When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

4. Connect cables **W3, W26** and **W30** to substitute module.

5. Turn instrument on.

6. Return to foldout.

## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A9.04** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 0 | |


Test operation of **substitute A9 Module** by repeating test performed on A9 Module before substitution.

**<u>Run Test</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

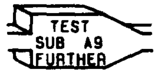
2. [SHIFT] [SPCL] [3] [3] [3] [5] [HZ].

3. When **"DIAG DONE HIT MSSG .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A9**.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A9.**

## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A9 Tests | **A9.05** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |




**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

The **A9** failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1:** **Instrument Level Self Test** indicated **A9** failure.
**Condition 2:** **A12 Module RF Power Test** indicated **A9** failure.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A9** failure.

**Condition 1**

1. [INSTR PRESET] [SHIFT)
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].
3. **When "WAITING FOR SETUP 1 .V24"** appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/,FM INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.
4. When **"DIAG DONE HIT MSSGS .VI"** appears:
   - Use [MSSG] to scroll through messages.
   - Record A9 error codes.

   **NOTE**

   If any error codes are displayed for modules A01 - A07, you need to isolate those failure(s) before performing the A9 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

5. Return to foldout.

## A9 MODULE DIAGNOSTICS

### Condition 2

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [3] [7] [HZ]

3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W26** from module at **A9A2 J3.**
   - Connect **YELLOW PM** cable and adapter to cable **W26**.
   - [HZ] to continue test.

4. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W26** to module at **A9A2 J3.**
   - Disconnect cable **W30** from module at **A9A1 J4**.
   - Connect **PM** cable to module at **A9A1 J4**.
   - [HZ] to continue test.

5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W30** to module at **A9A1 J4**.
   - [HZ] to continue test.

6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A9.**

7. Return to foldout.

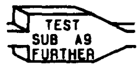
### Condition 3

1. Set instrument to operating condition which causes **A9 failure.**

2. Record instrument set-up and error message(s).

3. Return to foldout.

## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute A9 Tests | **A9.06** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

Test operation of s**ubstitute A9 Module** by repeating test(s) performed on A9 Module before substitution.

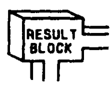
**Condition 1:** **Instrument Level Self Test** indicated **A9** failure**.**
**Condition 2:** **A12 Module RF Power Test** indicated **A9** failure.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A9** failure.

**Condition 1**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.
2. [SHIFT] SPCL) [3] [3] [0] [HZ].
3. When **"WAITING FOR SETUP 1 .V24"** appears:
   - Connect BNC Tee connector from On-Site Service Kit, to **"FM/FM INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - **[HZ]** to continue.
4. **When "DIAG DONE HIT MSSGS .VI"** appears:
   - Use [MSSG] to scroll through messages.
   - Record **A9** error codes.

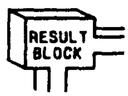
**NOTE**

If any error codes are displayed for modules A01 - A07, you need to isolate those failure(s) now.

5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each  for **TEST SUB A9 FURTHER.**

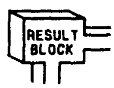
**Condition 2**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ 140.0DM"** appears, to override 20 second reset test.)
2. (SHIFT [SPCL] [3] [3] [3] [7] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W26** from module at **A9A12 J3**.
   - Connect **YELLOW PM** cable and adapter to cable **W26.**
   - [HZ] to continue test.
4. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W26** to module at **A9A2J3.**
   - Disconnect cable **W30** from module at **A9A1J4.**
   - Connect **PM** cable to module at **A9A1J4.**
   - [HZ] to continue test.
5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W30** to module at **A9A1 J4.**
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A9**.
7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A9 FURTHER.**




**Condition 3**

1. Set instrument to operating condition which causes **A9 failure**.
2. Record instrument set-up and error message(s).
3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A9 FURTHER. BLOCK.**



## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A9.07** |
| **Run time:** | 0 | |
| **Set-up time:** | 5 min. | |


### Connect Module

1. Switch instrument to **Standby.**

2. Disconnect cables **W3, W26** and **W30** from substitute **A9 Module.**

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

3. Reconnect cables **W3, W26** and **W30** to **A9 Module**.

4. Turn instrument on.

5. Return **substitute** A9 Module to On-Site Service Kit.

6. Return to foldout.

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A9.08** |
| **Run time:** | 2 min. 30 sec. | |
| **Set-up time:** | 3 min. | |

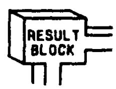

RF signal level is measured using Internal Power Meter **(PM).**

**CAUTION**

Do not permit end of Internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

## Run Test

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.0000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] SPCL) [3] [6] [8] [1] [2] [HZ]
   (To check input levels only
3. [3] [3] [7] [HZ].
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W26** from module at **A9A2 J3.**
   - Connect **YELLOW PM** cable and adapter to cable **W26**.
   - (HZ to continue test.
5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W26** to module at **A9A2 J3.**
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for A9.
7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **RF POWER.**



## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A9.09** |
| **Run time:** | 2 min. 30 sec. | |
| **Set-up time:** | 3 min. | |


RF signal level is measured using Internal Power Meter **(PM).**

### Run Test

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)

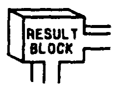
2. [SHIFT] [SPCL] [3] [6] [8] [1] [2] [HZ]
   (To check input levels only.)

3. [3] [3] [7] [HZ]

4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W26** from **A6 Module** at **A6A2 J6**. (See Top View Diagram inside **Top Cover** to locate **W26** connection on **A6 Module**.)
   - Connect **YELLOW PM** cable to module at **A6A2 J6**.
   - [HZ] to continue test.

5. When **"RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W26** to module at **A6A2 J6.**
   - [HZ] to continue test.

6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for A9.

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST CABLE W26**.

## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A9.10** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 5 min. | |


Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A9 Module** Data and Clock lines.

**NOTE**

If any control line level measures bad, it is not necessary to test remaining lines; proceed directly to step **23.**

**<u>Run Test</u>**

1. Switch instrument to **Standby:**
   - Disconnect cable **W3** from module at **A9A2 J1**.
   - Plug end of **W3** **<u>into</u>** **26 pin** test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W3PZ.**

**<u>CAUTION</u>**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A9 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

3. Turn instrument on.

## Data and Clock Control Lines

### Check High State

4. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state.)

**NOTE**

A "**0**" will appear in display indicating that these data bits will be set low. However, the bits are inverted in the Control Section before they are sent to **A9**.

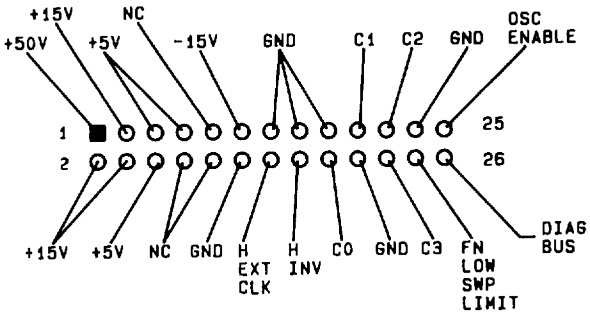
5. Enter **Bit Select Keys**, as indicated in Table **3H-1. W3P2 Control Bits,** for **Control Line** to be tested.

6. Connect **VM** probe to **Control Line** at **Pin Number** indicated in **Table 3H-1.** (See **Figure 3H-1. Cable Plug W3P2 Signal Locator.)**

**Table 3H-1. W3P2Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 5 and 10) | **Pin Number** (Step 6) |
|---|---|---|---|
| 1 | C0 | [3] [2] [HZ] | 18 |
| 2 | C1 | [3] [3] [HZ] | 19 |
| 3 | C2 | [3] (4) [HZ] | 21 |
| 4 | C3 | [3] [5] [HZ] | 22 |
| 5 | H INV | [3] [6] [HZ] | 16 |
| 6 | H EXT CLK | [3] [7] [HZ] | 14 |

**Figure 3H-1. Cable Plug W3P2 Signal Locator**




7. [2] [5] [HZ]
   (To enable voltmeter.)

8. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
   [5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify low state.

**NOTE**

A "**1**" will appear in display indicating that these data bits will be set high. However, the bits are inverted in the Control Section before they are sent to **A9.**

10. Enter **Bit Select Keys**, as indicated in **Table 3H-1. W3P2 Control Bits,** for same **Control Line.**

11. [2] [5] (H)
    (To enable voltmeter.)

12. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

13. Repeat procedure for each **Control Line** shown in **Table 3H-1**.

## Oscillator Enable

### Check High State

14. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify high state.)

15. [3] [8] [HZ]
    (To select bit.)

16. Connect **VM** probe to test connector line **OSC ENABLE** (pin **25**).

17. [2] [5] [HZ]
    (To enable voltmeter.)

18. Voltage should read approximately **+2..5** to **+5.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

### Check Low State

19. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To specify low state.)

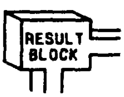
20. [3] [8] [HZ]
    (To select bit.)

21. [2] [5] [HZ]
    (To enable voltmeter.)

22. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

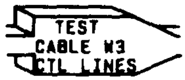
23. Record test results.

24. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CONTROL BITS.**



## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A9.11** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |




Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A9 Module** Clock and Data lines.

**<u>Run Test</u>**

1. Switch instrument to **Standby.**
2. Extend **A9 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W3** from **A5 Assembly** at **A5J3**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate **A9 Module** extension and AS cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W3.**

3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A9 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)
4. Turn instrument on.

**NOTE**

It is only necessary to perform this test on failing control line.

**<u>Data and Clock Control Lines</u>**

**Check High State**

5. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state.

**NOTE**

A "**0**" will appear in display indicating that these data bits will be set low. However, the bits are inverted in the Control Section before they are sent to **A9**.

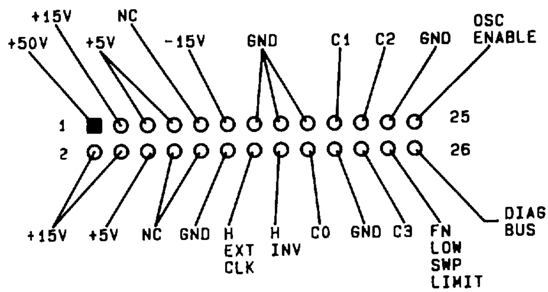
6. Enter **Bit Select Keys**, as indicated in Table **3H-2. A5J3 Control Bits**, for **Control Line** to be tested.

7. Connect **VM** probe to Control **Line** at **Pin Number** indicated in **Table 3H-2**. (See **Figure 3H-2. Cable Plug A5J3 Signal Locator.)**

**Table 3H-2. ASJ3 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 5 and 10) | **Pin Number** (Step 6) |
|---|---|---|---|
| 1 | C0 | [3] [2] [HZ] | 18 |
| 2 | C1 | [3] [3] [HZ] | 19 |
| 3 | C2 | [3] (4) [HZ] | 21 |
| 4 | C3 | [3] [5] [HZ] | 22 |
| 5 | H INV | [3] [6] [HZ] | 16 |
| 6 | H EXT CLK | [3] [7] [HZ] | 14 |

**Figure 3H-2. Cable Plug A5J3 Signal Locator**




8. [2] [5] [HZ]
   (To enable voltmeter.)

9. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
   [5] [HZ] to repeat measurement.)

**Check Low State**

10. (SHIFT [SPCL] [3] [6] [0] [1]
    (To specify low state.)

**NOTE**

A "**1**" will appear in display indicating that these data bits will be set high. However, the bits are inverted in the Control Section before they are sent to **A9**.

11. Enter **Bit Select Keys,** as indicated in **Table 3H-2. W3P2 Control Bits,** for same Control Line.
12. [2] [5] [HZ]
    (To enable voltmeter.)
13. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

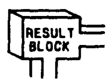
**<u>Oscillator Enable</u>**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify high state.)
15. [3] [8] [HZ]
    (To select bit.)
16. Connect **VM** probe to test connector line **OSC ENABLE** (pin **25**).
17. [2] [5] [HZ]
    (To enable voltmeter.)
18. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)
20. [3] [8] [HZ]
    (To select bit.)
21. [2] [5] [HZ]
    (To enable voltmeter.)
22. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)
23. Record test results.
24. Reconnect **W3** and lower **Module** back into instrument.
25. • Determine next task by comparing test results to conditions shown in each for **TEST CABLE W3 CTL LINES.**



## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A9.12** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter **(VM)** is used to check power supply levels at inputs to **A9 Module.**

**<u>Run Test</u>**

1. Switch instrument to **Standby:**
   - Disconnect **W3** from **A9** at **A9A2 J1.**
   - Plug end of **W3** <u>**into**</u> **26 pin** test connector, from On-Site Service Kit.

**NOTE**

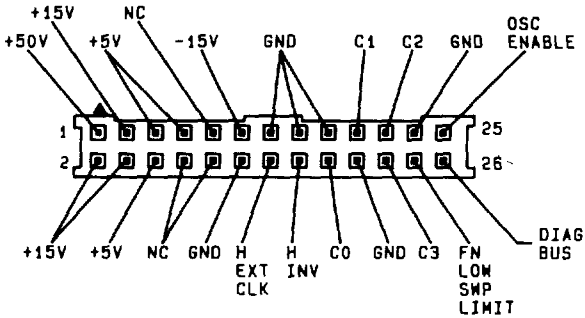
Find arrowhead on test connector and align with arrowhead on cable plug **W3P2.**

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A9 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

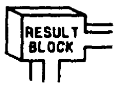
3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

4. Measure voltage levels:
   - Connect **VM** probe to test connector pin for each power supply line (see **Figure 3H-3. Cable Plug W3P2 Signal Locator).**
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3H-3. Cable Plug W3P2 Signal Locator**




5. Record test results.
6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST Vdc.**



## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A9.13** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 3 min. | |


Internal Voltmeter **(VM)** is used to check power supply levels at **A5J3**.

**Run Test**

1. Switch instrument to **Standby.**

2. Extend **A9 Module** on extender posts, from On-Site Service Kit and disconnect cable **W3** from **A5 Assembly** at **A5J3.** (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate A9 Module extension and AS cable disconnection information.)

**NOTE**

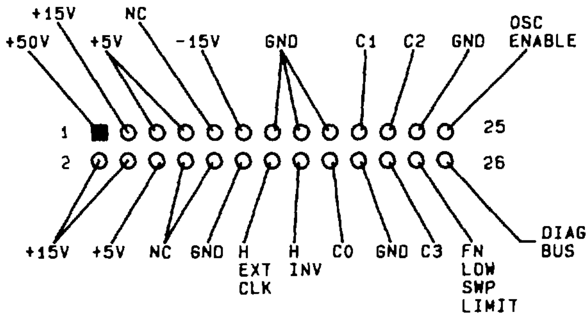
It may be necessary to remove **A4** (para 5-6) to disconnect cable **W3**.

3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A9 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

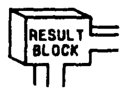
4. Turn instrument on and enter:
   [SHIFT] (SPCL [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

5. Measure voltage levels at **A5J3:**
   - Access signals from solder-side of **A5J3.** (See **Figure 3H-4**. **A5J3 Signal Locator**.)
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3H-4. A5J3 Signal Locator**
**(Solder-Side View)**

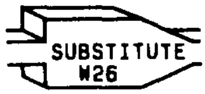



6. Record test results.
7. Reconnect **W3** and lower **Module** back into instrument.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W3 PS LINES.**



## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A9.14** |
| **Run Time:** | 5 min. | |
| **Set-up Time:** | 1 min. | |

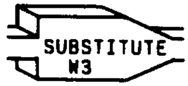



1. Testing has shown cable **W26** to be suspect, temporarily replace with a test cable from the On-Site Service Kit. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

2. Deleted.

3. Return to foldout.

## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A9.15** |
| **Run time:** | 0 min. |  |
| **Set-up time:** | 3 min. | |



Testing has shown cable **W3** to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

**CAUTION**

When connecting ribbon cable to A9 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W3**

1. Switch instrument to Standby to connect cable **W3** to **A5** Assembly and **A9** Module. (Refer to **MECHANICAL PROCEDURES** for information on connecting cable **W3** to **A5J3.)**

2. Return to foldout.

## A9 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A9.16** |
| **Run time:** | 0 min. |  |
| **Set-up time:** | 3 min. | |

**CAUTION**

When connecting ribbon cable to A9 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W3**

1. Switch instrument to Standby to reconnect cable **W3** to **A5** Assembly or **A9** Module. (Refer to **MECHANICAL PROCEDURES** for information on reconnecting cable **W3** to A5J3.)

2. Return to foldout.

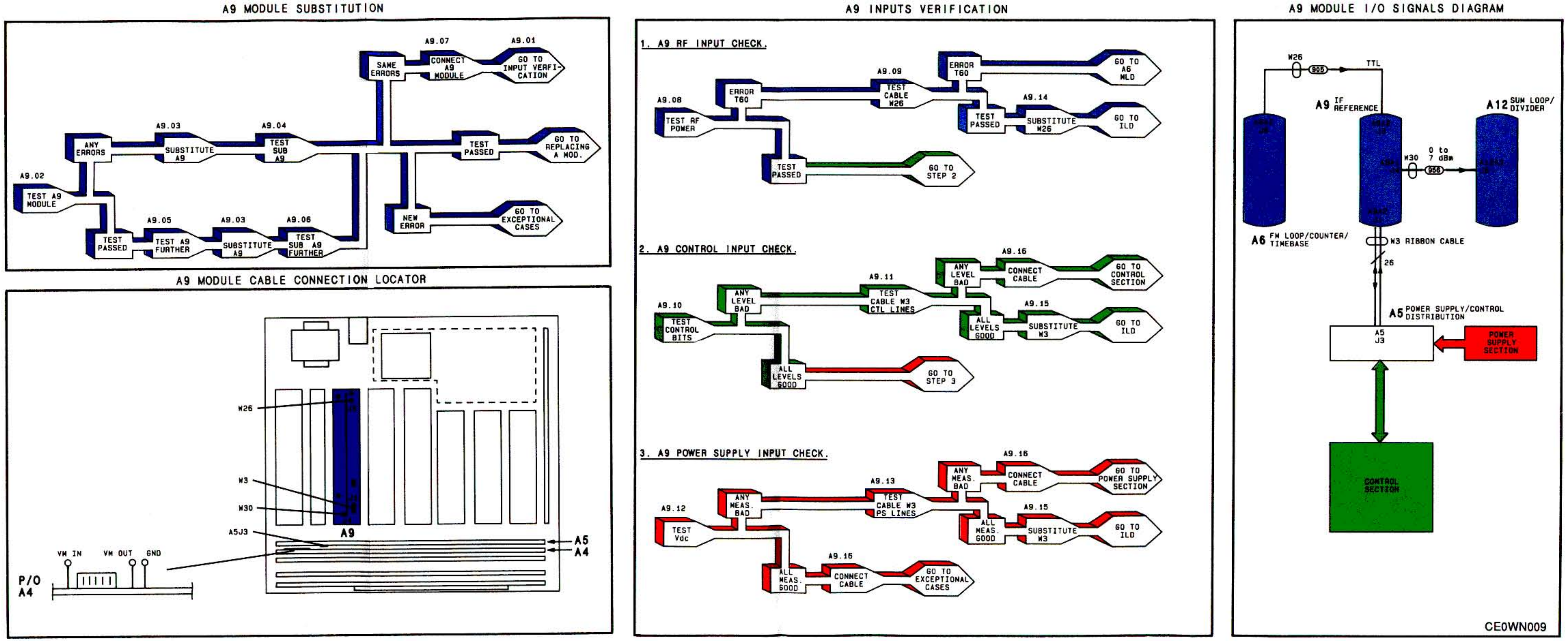



Figure 3H-100. A9 IF Reference Module Diagnostics.

## A11 REFERENCE LOOP MODULE

### 31-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A11 Module**. The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01 - A09.** (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or .74 ft-lbs (slightly tighter than finger tight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptable to short circuiting.

**Test Instructions**

1. The instrument's **Top Cover** must be removed to run many of these tests. (Refer to the table shown on the foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. **The last page in this group of tests is a foldout and should be pulled out now.**

3. Turn to the next page to begin the **A11 MLD.**

## A11 INPUTS VERIFICATION

### 31-2. INTRODUCTION

The first step in isolating a failure in the **A11 Module** is to verify correct operation of each input signal. Use the **A11 INPUTS VERIFICATION** procedure to check each signal path into the A11 Module.

**A11 Inputs Verification Instructions**

1. Find **A11 INPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown under **A11 INPUTS VERIFICATION**, are separated into three checks: **RF, Control** and **Power Supply** signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order they are arranged in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under **1. A11 RF INPUT CHECK.**

**NOTE**

The **A11 MODULE I/O SIGNALS DIAGRAM** shows all parts which the All Module depends on for operation.

A11.01


## 31-3. INTRODUCTION

If you were unable to isolate the failure using the **A11 INPUTS VERIFICATION** procedure, then follow the Task Sequence Diagram, shown under **A11 MODULE SUBSTITUTION**, to substitute in a known good module from the On-site Service Kit.

**NOTE**

If a known good module is not available, proceed to **Exceptional Case 1** (Condition 2) in the **EXCEPTIONAL CASES** Section.

**A11 Substitution Instructions**

1. Find **A11 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A11 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A11 MODULE DIAGNOSTICS

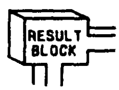
| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A11.02** |
| **Run time:** | 20 sec. | |
| **Set-up time:** | 3 min. | |


RF signal level is measured using Internal Power Meter **(PM).**

**CAUTION**

Do not permit end of Internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] [8] [1] [3] [HZ]
   (To check Input levels only.)
3. [3] [3] [1] [HZ].
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W25** from module at **A11A3 14**.
   - Connect **YELLOW PM** cable and adapter to cable **W25.**
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W25** to module at **A11A3 J4.**
   - Disconnect cable **W24** from module at **A11A1 J3.**
   - Connect **YELLOW PM** cable and adapter to cable **W24**.
   - [HZ] to continue test.
6. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable W24 to module at **A11A1 J3**.
   - [HZ] to continue test.
7. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST RF POWER**.

## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A11.03** |
| **Run time:** | 10 sec. |  |
| **Set-up time:** | 2 min. | |



RF signal level is measured using Internal Power Meter **(PM).**

**Run Test**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [6] [8] [1] [2] [HZ]
   (To check input levels only.)

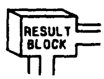
3. [3] [3] [1] [HZ]

4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W25** from **A7 Module** at **A7A1 J3.**
     (See Top View Diagram inside **Top Cover** to locate **W25** connection on **A7 Module**.)
   - Connect YELLOW PM cable to module at **A7A1 J3**.
   - [HZ]  to continue test.

5. When **"RECONNECT ALL CABLES  .V29"** appears:
   - Reconnect cable **W25** to module at **A7A1 J3**.
   - [HZ] to continue test.

6. When **"DIAG DONE   HIT MSSGS.V1"** appears:
   - Use [MSSG] to scroll through messages.

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W25.**



## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A11.04** |
| **Run time:** | 15 sec. | |
| **Set-up time:** | 2 min. | |


RF signal level is measured using Internal Power Meter **(PM).**

**Run Test**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [6] [8] [1] [3] [HZ]
   (To check input levels only.)

3. [3] [3] [1] [HZ]

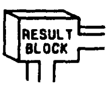
4. When **"WAITING FOR SET-UP 1  .V24"** appears:
   - Disconnect cable **W25** from module at **A7A1 J3.**  (See Top View Diagram inside **Top Cover** to locate **W25** connection on **A7 Module**.)
   - Connect **YELLOW PM** cable to module at **A7A1 J3**.
   - [HZ] to continue test.

5. When **"WAITING FOR SET-UP 2  .V25"** appears:
   - Reconnect cable W25 to module at **A7A1 J3**.
   - Disconnect cable **W24** from module at **A6A1 J2**.
   - Connect **YELLOW PM** cable to module at **A6A1 J2**.
   - [HZ] to continue test.

6. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W24** to module at **A6A1 J2.**
   - [HZ] to continue test.

7. When **"DIAG DONE   HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.

8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W24.**



## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A11.05** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A11 Module** on Clock and Data control lines.

### Run Test

1. Switch instrument to Standby:
   - Disconnect cable **W4** from module at **A11A1 J1**.
   - Plug end of **W4** **into** **16 pin** test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W4P2.**

**CAUTION**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect Alligator clip to **VM IN (A4TPI)**. (See **A11 MODULE CABLE CONNECTION LOCATOR** on fold- out for **VM IN** location.)
3. Turn instrument on.

### Clock Line

**Check High State**

4. [SHIFT] [SPCL].[3] [6] [0] [2]
   (To specify high state.)

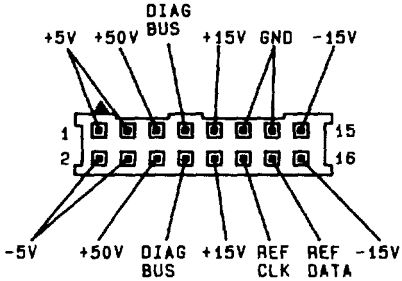
**NOTE**

A "**0**" will appear in display indicating that the data bit will be set low. However, the bit is inverted in the Control Section before it is sent to **A11**.

5. [4] [2] [HZ]
   (To select bit.)

6. Connect **VM** probe to test connector line **REF CLK** (pin **12**). (See **Figure 31-1. Cable Plug W4P2 Signal Locator.)**

**Figure 31-1. Cable Plug W4P2 Signal Locator**




7. [2] [5] [HZ]
   (To enable voltmeter.)
8. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
   ([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] ( SPCL)[3] [6] [0] [1]
   (To specify low state.)

**NOTE**

A "**1**" will be appear in display indicating that the data bit will be set high. However, the bit is inverted in the Control Section before it is sent to **A11**.

10. [4] [2] [HZ]
    (To select bit.)
11. [2] [5] [HZ]
    To enable voltmeter.)
12. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

## A11 MODULE DIAGNOSTICS

### Data Line

**Check High State**

13. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To specify high state.)

14. [4] [3] [HZ]
    (To specify bit.)

15. Connect **VM** probe to test connector line **REF DATA** (pin **14**). (See **Figure 31-1. Cable Plug W4P2 Signal Locator**.)

16. [2] [5] [HZ]
    (To enable voltmeter.)

17. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

**Check Low State**

18. [SHIFT] [SPCL ] [3] [6] [0] [1]
    (To specify low state.)

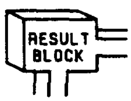
19. [4] [3] [HZ]
    (To select bit)

20. [2] [5] [HZ]
    (To enable voltmeter.)

21. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

22. Record test results.

23. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CONTROL BITS.**



## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type**: | 3; Bit Transmission | **A11.06** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |


Internal Voltmeter **(VM)** is used to measure **TTL** level changes transmitted to **A11 Module** on Clock and Data control lines.

### Run Test

1. Switch instrument to **Standby.**
2. Extend **A11 Module** on extender posts, from On-Site Service Kit to disconnect cable **W4** from **A5 Assembly** at **A5J4.** (See table on foldout in **MECHANICAL PROCEDURES** to locate **A11** Module extension and A5 cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W4.**

3. Connect **VM** probe:
   - Connect red Alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect Alligator clip to **VM IN (A4TP1).** (See **A11 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)
4. Turn instrument on.

### Clock Line

**Check High State**

5. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify high state.)

**NOTE**

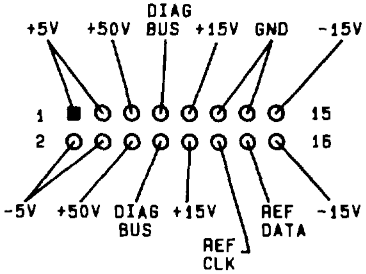
A "**0**" will appear in display indicating that the data bit will be set low. However, the bit is inverted in the Control Section before it is sent to **A11**.

6. [4] [2] [HZ]
(To select bit.)

## A11 MODULE DIAGNOSTICS

7. Connect **VM** probe to solder-side of **A5J4**, line **REF CLK** (pin **12**). (See **Figure 31-2. A5J4 Signal Locator.)**

**Figure 31-2. A5J4 Signal Locator**
**(Solder-Side View)**




8. [2] [5] [HZ]
   (To enable voltmeter.)

9. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
   ([5] to repeat measurement.)

**Check Low State**

10. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)

**NOTE**

A "**1**" will be displayed indicating that the data bit will be set high. However, the bit is inverted in the Control Section before it is sent to **A11**.

11. [4] [2] [HZ]
    (To select bit.)
12. [2] [5] [HZ]
    (To enable voltmeter.)
13. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

## A11 MODULE DIAGNOSTICS

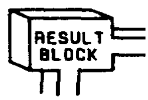
**Data Line**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To specify high state.)
15. [4] [3] [HZ]
    (To select bit.)
16. Connect **VM** probe to solder-side of **A5J4** line **REF DATA** (pin **14**). (See **Figure 31-2. A5J4 Signal Locator.**)
17. [2] [5] [HZ]
    (To enable voltmeter.)
18. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)
20. [4] [3] [HZ]
    (To enable voltmeter.)
21. [2] [5] [HZ]
    (To enable voltmeter.)
22. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] HZ) to repeat measurement.)
23. Record test results.
24. Reconnect **W4** and lower **Module** back into instrument.
25. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W4 CTL LINES**



## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A11.07** |
| **Run time:** | 3 min. |   |
| **Set-up time:** | 2 min. | |

Internal Voltmeter **(VM)** is used to check power supply levels at inputs to **A11 Module.**

**<u>Run Test</u>**

1. Switch instrument to Standby:
   - Disconnect **W4** from A11 at **A11A1 J1.** Plug end of **W4 <u>into</u> 16 pin** test connector, from On-Site Service Kit.

**NOTE**

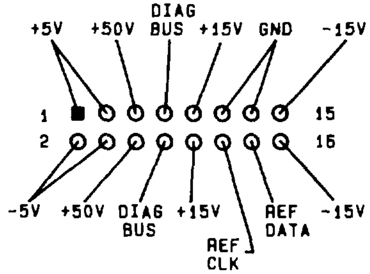
Find arrowhead on test connector and align with arrowhead on cable plug **W4P2.**

2. Connect **VM** probe:
   - Connect red Alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect Alligator clip to **VM IN (A4TP1).** (See **A11 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

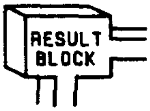
3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

4. Measure voltage levels:
   - Connect VM probe to test connector pin for each power supply line (see **Figure 31-3. Cable Plug W4P2 Signal Locator).**
   - [5] [HZ] (To make each voltage measurement.)

**Figure 31-3. Cable Plug W4PZ Signal Locator**




5. Record test results.
6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST Vdc.**



## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A11.08** |
| **Run time:** | 3 min. |  |
| **Set-up time**: | 3 min. | |

Internal Voltmeter **(VM**) is used to check power supply levels at **A5J4.**

**<u>Run Test</u>**

1. Switch instrument to Standby.
2. Extend **A11 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W4** from **A5 Assembly** at **A5J4.** (See table on foldout in **MECHANICAL PROCEDURES** to locate **A11 Module** extension and **A5** cable disconnection information.)

**NOTE**

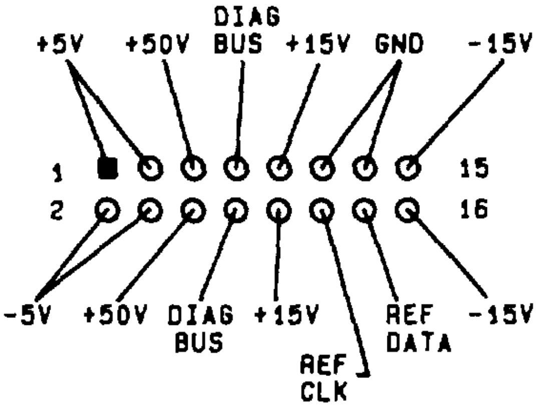
It may be necessary to remove **A4** (para 5-6) to disconnect cable **W4.**

3. Connect **VM** probe:
   - Connect red Alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect Alligator clip to **VM IN (A4TP1).** (See **A11 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

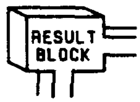
4. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

5. Measure voltage levels at **A5J4**:
   - Access signals from solder-side of **A5J4.** (See Figure **31-4. A5J4 Signal Locator.**) It may be necessary to extend the **A11 Module** to access the solder-side of **A5J4**. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information.)
   - [5] [HZ] (To make each voltage measurement.)

**Figure 31-4. ASJ4 Signal Locator**
**(Solder-Side View)**




6. Record test results.
7 Reconnect **W4** and lower **Module** back into instrument.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W4 PS LINES.**



| | | |
|---|---|---|
| **Type:** | 1 Loop Lock/Unlock | **A11.09** |
| **Run time:** | 15 sec. | |
| **Set-up time:** | 0 | |


**Run Test**

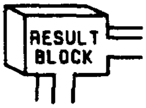
1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [2] (9) [HZ].
3. When **"DIAG DONE HIT MSSG .V1"** appears:
   - Use (MSSG ) to scroll through messages.
   - Record error code(s) displayed for **A11**. If "**TEST 1 OF A11** (**PASSED** or **FAILED**) is not displayed, rerun test.

**NOTE**

If any error codes are displayed for modules A01 - A09, you need to isolate those failure(s) before performing the A11 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST A11 MODULE.**



## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A11.10** |
| **Run time:** | 0 | |
| **Set-up time:** | 5 min. |  |



The following describes the technique for connecting a known good A11 Module **without removing** the A11 module in the instrument.

**Connect Substitute Module**

1. Switch instrument to Standby.

2. Disconnect cables **W4, W24 W25** and **W31** from **A11 Module** (see **A11 MODULE CABLE CONNECTION LOCATOR** on foldout).

3. Without removing **A11 Module** from instrument, carefully lay substitute **A11 Module** on top of modules **A6, A7** and **A9.**

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

4. Connect cables **W4, W24, W25** and **W31** to substitute module.

**Down-Load Cal Data**

**CAUTION**

Use adequate Electrostatic Discharge Techniques when handling the A20 Calibration Module.

5. Remove from On-Site Service Kit **A20 Calibration Module** provided for substitute A11 Module.

## A11 MODULE DIAGNOSTICS

**CAUTION**

Check that switch S1 on A20 Module is switched up to its "**PROTECTED**" position.

6. With instrument switched to **Standby** connect **A20 Module** to **A3 Module** at **A3J3** (see **A11 MODULE CABLE CONNECTION LOCATOR** on foldout).

7. Turn instrument on.

8. When **"100.000000MZ   -140.00 DM"** appears:
   - Slide switch on left side of **A3S2** on **A3 Module** back toward rear of instrument (see **A11 MODULE CABLE CONNECTION LOCATOR** on foldout).

9. [SHIFT] [SPCL] [3] [7] [3] [1] [HZ]

10. When **"TRANSFER VERIFIED  .U613"** appears:
    - Slide **A3S2** forward toward front of instrument to **protect A3 Module's** memory.

11. Switch Instrument to **Standby** and remove **A20 Module. Replace A20 Module in On-Site Service Kit.**

12. Return to foldout.

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A11.11** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 0 | |


Test operation of **substitute A11 Module** by repeating test performed on A11 Module before substitution.

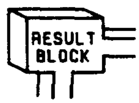
**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [2] (9) [HZ]

3. When **"DIAG DONE  HIT MSSG .V1"** appears:
   - Use[MSSG] to scroll through messages.
   - Record error code(s) displayed for **A11.** If **"TEST 1 OF A11** (**PASSED** or **FAILED**)" is not displayed, rerun test.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A11**.



## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A11 Tests | **A11.12** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

The **A11** failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1:** **Instrument Level Self Test** indicated **A11** failure.
**Condition 2:** **A12 Module RF Power Test** indicated **A11** failure.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A11** failure.

### Condition 1

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/ΦM INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.
4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record **A11** error codes.

**NOTE**

If any error codes are displayed for modules A01 - A09, you need to isolate those failure(s) before performing the A11 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

5. Return to foldout.

## A11 MODULE DIAGNOSTICS

### Condition 2

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.).
2. [SHIFT] [SPCL] [3] [3] [3] [1] [HZ]
3. When **"WAITING FOR SET-UP 1 V24"** appears:
   - Disconnect cable **W25** from module at **A11A3 J4**.
   - Connect **YELLOW PM** cable and adapter to cable **W25**.
   - [HZ] to continue test.
4. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W25** to module at **A11A3 J4.**
   - Disconnect cable **W24** from module at **A11A1 J3.**
   - Connect **PM** cable and adapter to W24.
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 3 .V26"** appears:
   - Reconnect cable **W24** to module at **A11A1 J3**.
   - Disconnect cable **W31** from module at **A11A3 J2**.
   - Connect **PM** cable to module at **A11A3 J2.**
     [HZ] to continue test.
6. When **"RECONNECT A11 CABLES .V29"** appears:
   - Reconnect cable **W31** to module at **A11A3 J2.**
   - [HZ] to continue test.
7. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use[MSSG] to scroll through messages.
   - Record error code(s) displayed for **A11.**
8. Return to foldout.

### Condition 3

1. Set instrument to operating condition which causes **A11 failure.**
2. Record instrument set-up and error message(s).
3. Return to foldout.

| | | |
|---|---|---|
| **Type:** | Additional Substitute A11 Tests | **A11.13** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

Test operation of substitute **A11 Module** by repeating test(s) performed on **A11 Module** before substitution.

**Condition 1:** **Instrument Level Self Test** indicated **A11 failure.**
**Condition 2:** **A12 Module RF Power Test** indicated **A11 failure**.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A11 failure**.

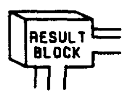
**Condition 1**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.0000000MZ -140.0DM"** appears, to override 20 second reset test.
2. [SHIFT] [SPCL] [3] [3] [0] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Connect BNC Tee connector from On-Site Service Kit, to **"FM/ΦM INPUT'** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.
4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record **A11** error codes.

**NOTE**

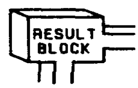
If any error codes are displayed for modules A01 - A09. you need to isolate those failure(s) now.

5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A11 FURTHER.**



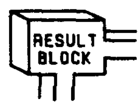
## A11 MODULE DIAGNOSTICS

**Condition 2**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [3] [1] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W25** from module at **A11A3 J4.**
   - Connect **YELLOW PM** cable and adapter to cable **W25.**
   - [HZ] to continue test.
4. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W25** to module at **A1A3 J4.**
   - Disconnect cable **W24** from module at **A11A1 J3.**
   - Connect **PM** cable to module at **A11A1 J3.**
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 3 .V26"** appears:
   - Reconnect cable **W24** to module at **A11A1 J3.**
   - Disconnect cable **W31** from module at **A11A3 J2.**
   - Connect PM cable to module at **A11A3 J2.**
   - [HZ] to continue test.
6. When **"RECONNECT A11 CABLES .V29"** appears:
   - Reconnect cable W31 to module at **A11A3 J2.**
   - [HZ] to continue test.
7. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use (MSSG ) to scroll through messages.
   - Record error code(s) displayed for **A11**.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST SUB A11 FURTHER.**

**Condition 3**

1. Set instrument to operating condition which causes **A11** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST SUB A11 FURTHER.**

## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Replacement | **A11.14** |
| **Run time:** | 10 sec. |  |
| **Set-up time:** | 5 min. | |

### Connect Module

1. Switch instrument to Standby.

2. Disconnect cables **W4, W24, W25** and **W31** from substitute **A11 Module**.

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

3. Reconnect cables **W4, W24, W25** and **W31** to **A11 Module**.
4. Return **substitute A11 Module** to On-Site Service Kit.

### Down-Load Cal Data

**CAUTION**

Use adequate Electrostatic Discharge Techniques when handling the A20 Calibration Module.

5. After making sure that A20 Module for substitute **A11 Module** has been returned to On-Site Service Kit, remove **A20 Calibration Module** from Rear Panel (see **MECHANICAL PROCEDURES** for removal information).

## A11 MODULE DIAGNOSTICS

**CAUTION**

Check that switch S1 on A20 Module is switched up to its "**PROTECTED**" position.

6. With instrument switched to Standby, connect **A20 Module to A3 Module** at **A3J3**.

7. Turn instrument on.

8. When **"100.000000MZ -140.00 DM"** appears:
   - Slide switch on left side of **A3S2 on A3 Module** back toward rear of instrument.

9. [SHIFT] [SPCL] [3] [7] [3] [1] [HZ]

10. When **"TRANSFER VERIFIED .U613"** appears:
    - Slide **A3S2** forward toward front of instrument to protect **A3 Module's** memory.

11. Switch Instrument to Standby and remove **A20 Module. Replace A20 Module on Rear Panel.**

12. Return to foldout.

## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A11.15** |
| **Run Time:** | 5 min. |  |
| **Set-up Time:** | 1 min. | |

1. Testing has shown cable **W24** or **W25** to be suspect, temporarily replace it with a test cable from the On-Site Service Kit. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

2. Deleted.

3. Return to foldout.

## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A11.16** |
| **Run time:** | 0 min. |  |
| **Set-up time:** | 3 min. | |

Testing has shown cable **W4** to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

**CAUTION**

When connecting ribbon cable to A11 Module, find arrowhead on the cable plug and align with arrow-head on the board connector.

**Reconnect W4**

1. Switch instrument to **Standby** to connect cable **W4** to **A5** Assembly and **A11** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on connecting cable **W4** to **A5J2**.)

2. Return to foldout.

## A11 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A11.17** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 3 min. | |


**CAUTION**

When connecting ribbon cable to A11 Module, find arrowhead on the cable plug and align with arrow- head on the board connector.

**Reconnect W4**

1. Switch instrument to Standby to reconnect cable **W4** to **A5** Assembly or **A11** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on reconnecting cable **W4** to **ASJ2**.)

2. Return to foldout.

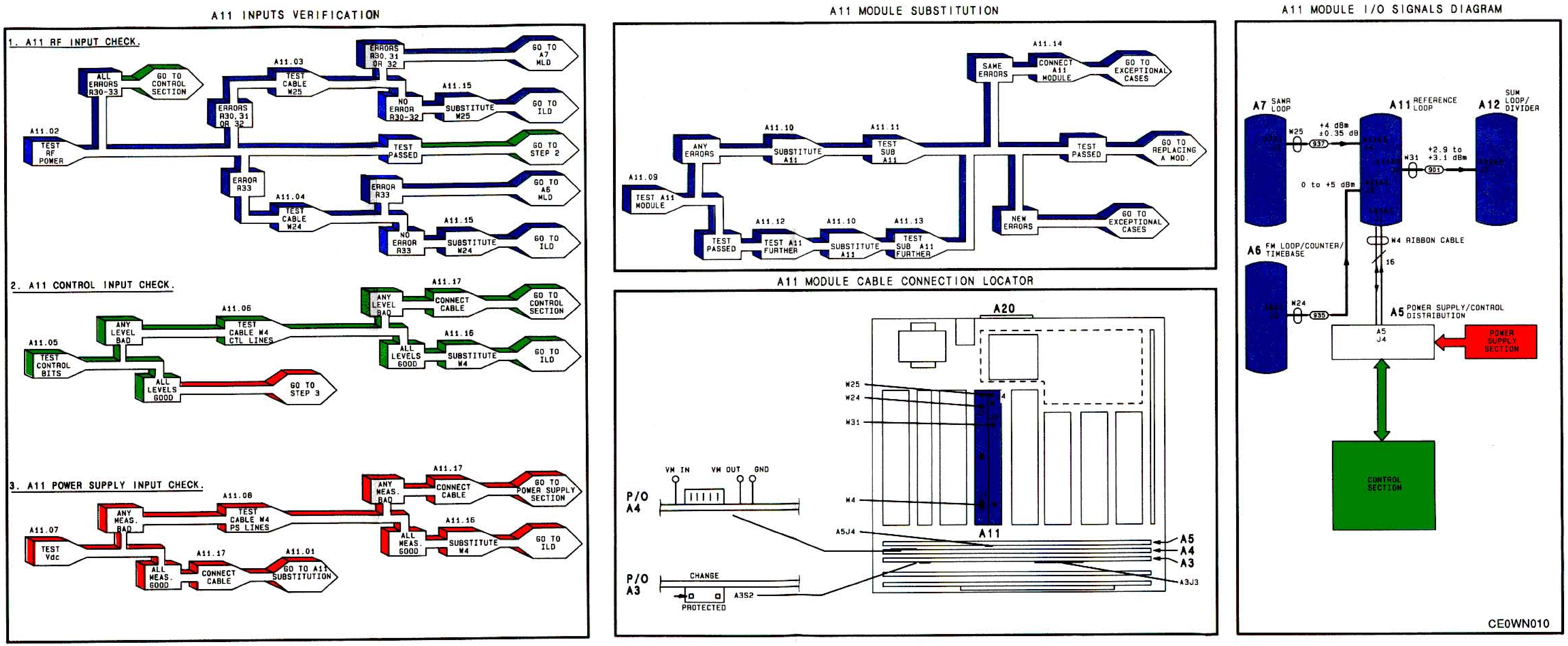



Figure 31-100. A11 reference Loop Module Diagnostics.

## A12 SUM LOOP/DIVIDER MODULE

### 3J-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A12 Module**. The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01 - A11.** (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or .74 ft-lbs (slightly tighter than finger tight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptible to short circuiting.

**Test Instructions**

1. The instrument's **Top Cover** must be removed to run many of these tests. (Refer to the table shown on the foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. **The last page in this group of tests is a foldout and should be pulled out now.**

3. Turn to the next page to begin the **A12 MLD.**

## A12 INPUTS VERIFICATION

### 3J-2. INTRODUCTION

The first step in isolating a failure in the **A12 Module** is to verify correct operation of each input signal. Use the **A12 INPUTS VERIFICATION** procedure to check each signal path into the **A12 Module.**

**<u>A12 Inputs Verification Instructions</u>**

1. Find A12 INPUTS VERIFICATION on the foldout.

2. The Task Sequence Diagrams, shown under **A12 INPUTS VERIFICATION**, are separated into three checks: **RF, Control** and **Power Supply** signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the page indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

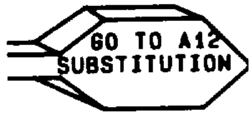
5. Begin now by performing the first task shown under **1. A12 RF INPUT CHECK**

**NOTE**

The **A12 MODULE I/O SIGNALS DIAGRAM** shows **A11** parts which the **A12 Module** depends on for operation.

## A12 MODULE SUBSTITUTION

A12.01




### 3J-3. INTRODUCTION

If you were unable to isolate the failure using the **A12 INPUTS VERIFICATION** procedure, then follow the Task Sequence Diagram, shown under **A12 MODULE SUBSTITUTION**, to substitute in a known good module from the On-Site Service Kit.

**NOTE**

If a known good module is not available, proceed to **Exceptional Case 2** (Condition 2) in the **EXCEPTIONAL CASES** Section.

**<u>A12 Substitution Instructions</u>**

1. Find **A12 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A12 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A12.02** |
| **Run time:** | 4 min. |   |
| **Set-up time:** | 3 min. | |

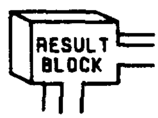
**RF** signal level is measured using Internal Power Meter **(PM).**

**CAUTION**

Do not permit end of Internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] [8] [1] [3] [HZ]
   (To check Input levels only.)
3. [3] [4] [5] [HZ]
4. When **"WAITING FOR SET-UP 1  .V24"** appears:
   - Disconnect cable **W31** from module at **A12A2 J2.**
   - Connect **YELLOW PM** cable and adapter to cable **W31.**
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 2  .V25"** appears:
   - Reconnect cable **W31** to module at **A12A2 J2**.
   - Disconnect cable **W30** from module at **A12A3 J6**.
   - Connect **YELLOW PM** cable and adapter to cable **W30**.
   - [HZ] to continue test.
6. When **"RECONNECT A11 CABLES .V29"** appears:
   - Reconnect cable **W30** to module at **A12A3 J-6**.
   - [HZ] to continue test.
7. When  **"DIAG DONE   HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record test results.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST RF POWER**.



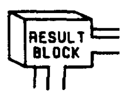
## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A12.03** |
| **Run time:** | 4 min. |  |
| **Set-up time:** | 2 min. | |

**RF** signal level is measured using Internal Power Meter (**PM**).

**<u>Run Test</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] [8] [1] [3] [HZ]
   (To check input levels only)
3. [3] [4] [5] [HZ]
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W31** from **A11 Module** at **A11A3 J2.**
     (See Top View Diagram inside Top Cover to locate **W31** connection on **A11 Module**.)
   - Connect **YELLOW PM** cable to module at **A11A3 J2**.
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W31** to module at **A11A3 J2.**
   - Disconnect cable **W30** from module at **A9A1 J4.**
   - Connect **YELLOW PM** cable to module at **A9A1 J4.**
   - [HZ] to continue test.
6. When **"RECONNECT A11 CABLES .V29"** appears:
   - Reconnect cable **W30** to module at **A9A1 J4.**
   - to continue test.
7. When **"DIAG DONE HIT MSSGS .V"** appears:
   - Use [MSSG] to scroll through messages.
   - Record test results.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W30.**



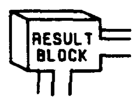
## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A12.04** |
| **Run time:** | 4 min. | |
| **Set-up time:** | 2 min. | |


**RF** signal level is measured using Internal Power Meter (**PM**).

**<u>Run Test</u>**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until **"100.000000MZ   -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] [8] [1] [2] [HZ]
   (To check input levels only.)
3. [3] [4] [5] [HZ]
4. When **"WAITING FOR SET-UP 1  .V24"** appears:
   - Disconnect cable **W31** from **A11 Module** at **A11A3 J2.**
     (See Top View Diagram inside Top Cover to locate **W31** connection on **A11 Module.**)
   - Connect **YELLOW PM** cable to module at **A11A3 J2**.
- [HZ] to continue test.
5. When **"RECONNECT A11 CABLES .V29"** appears:
   - Reconnect cable **W31** to module at **A11A3 J2.**
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS .VI"** appears:
   - Use [MSSG] to scroll through messages.
   - Record test results.
7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W31.**



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A12.05** |
| **Run time:** | 5 min. | |
| **Set-up time:** | 5 min. | |


Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A12 Module** on Clock, Data and Divider control lines.

**NOTE**

If any control line level is bad, it is not necessary to test remaining lines; proceed to step **24**.

**Run Test**

1. Switch instrument to **Standby**:

**NOTE**

A12 Module must be lifted slightly to disconnect WS. Release module retaining clips (at each end of module) from slide posts. Lift module up high enough to disconnect W5.

- Disconnect cable **W5** from module at **A12A3 J1**.
- Plug end of **W5 <u>into</u> 26** pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **WSP2.**

**<u>CAUTION</u>**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A12 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

3. Turn instrument on.

## Clock and Data Control Lines

### Check High State

4. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To set bit high).

**NOTE**

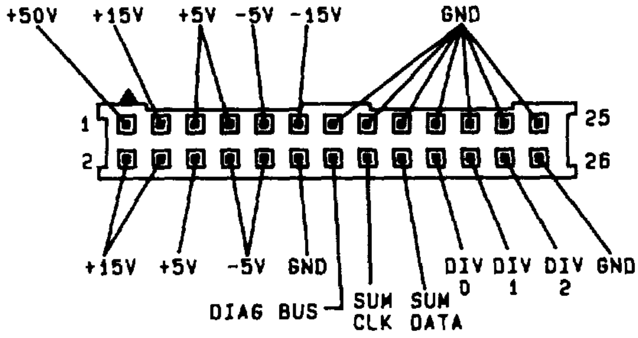
A "**0**" will appear in display indicating that the data bits will be set low. However, the bits are inverted in the Control Section before they are sent to **A12**.

5. Enter **Bit Select Keys**, as indicated in Table **3J-1. W5P2 Control Bits**, for **Control Line** to be tested.
6. Connect **VM** probe **Control Line** at Pin Number indicated in Table **3J-1**. (See **Figure 3J-1. Cable Plug W5P2 Signal Locator.)**

**Table 3J-1. W5P2 Control Bits**

| Test Order | Control Line | Bit Select Keys (Steps 5 and 10) | Pin Number (Step 6) |
|---|---|---|---|
| 1 | SUM CLK | [4] [4] [HZ] | 16 |
| 2 | SUM DATA | [4] [5] [HZ] | 18 |

**Figure 3J-1. Cable Plug W5P2 Signal Locator**



7. [2] [5] [HZ]
   (To enable voltmeter.)
8. Voltage should read approximately **+2.5 to +5.5 Vdc.**
   ([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To set bit low.)

**NOTE**

A "**1**" will appear in display indicating that the data bits will be set high. However, the bits are inverted in the Control Section before they are sent to **A12**.

10. Enter **Bit Select Keys**, as indicated in **Table 3J-1. W5P2 Control Bits**, for same **Control Line.**
11. [2] [5] [HZ]
    (To enable voltmeter.)
12. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)
13. Repeat procedure for each **Control Line** shown in **Table 3J-1.**

**Divider Control Lines**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To set bit high.)

**NOTE**

This bit is not inverted in the Control Section before it is sent to A 12.

15. Enter **Bit Select Keys**, as indicated in Table **3J-2. W5P2 Control Bits**, for **Control Line** to be tested.
16. Connect **VM** probe **Control Line** at **Pin Number** indicated in **Table 3J-2**. (See **Figure 3J-1. \ Cable Plug WSP2 Signal Locator.)**

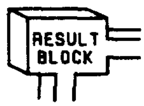
**Table 3J-2. W5P2 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 15 and 20) | **Pin Number** (Step 16) |
|---|---|---|---|
| 1 | DIV 0 | [2] (7) [HZ] | 20 |
| 2 | DIV 1 | [2] [8] [HZ] | 22 |
| 3 | DIV 2 | [2] (9) [HZ] | 24 |

17. [2] [5] [HZ]
    (To enable voltmeter.)
18. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
    ([5] [HZ] to repeat message.)

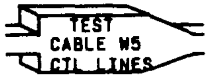
**Check Low State**

19. [SHIFT] [SPCL]
    (To set bit low.)
20. Enter **Bit Select Keys**, as indicated in Table **3J-2. W5P2 Control Bits**, for same **Control Line.**
21. [2] [5] [HZ]
    (To enable voltmeter.)
22. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)
23. Record test results.
24. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CONTROL BITS.**



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A12.06** |
| **Run time:** | 5 min. | |
| **Set-up time:** | 2 min. | |




Internal Voltmeter **(VM)** is used to measure **TTL** level changes transmitted to **A12 Module** on Clock, Data and Divider control lines.

### Run Test

1. Switch instrument to Standby.
2. Extend **A12 Module** on extender posts, from On-Site Service Kit. to disconnect cable **W5** from **A5** Assembly at **A5J5.** (See table on foldout in **MECHANICAL PROCEDURES** to locate **A12** Module extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W5.**

3. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A12 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location).
4. Turn instrument on.

**NOTE**

It is only necessary to perform test on failing control line.

### Clock and Data Control Lines

**Check High State**

5. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state.)

**NOTE**

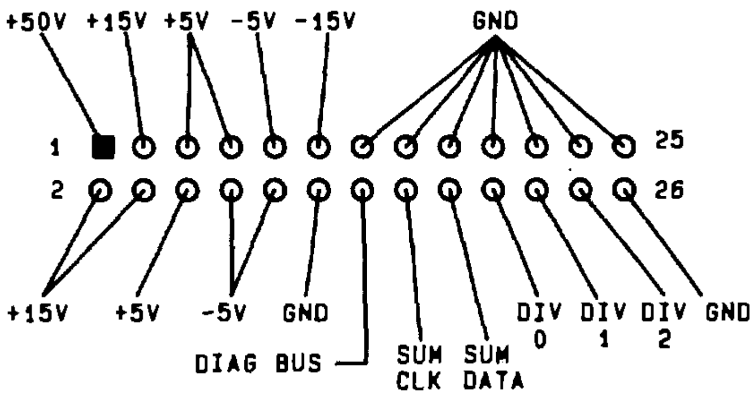
A "**0**" will appear in display indicating that the data bits will be set low. However, the bits are inverted in the Control Section before they are sent to **A12**.

6. Enter **Bit Select Keys**, as indicated in **Table 3J-3. A5J5 Control Bits**, for **Control Line** to be tested.
7. Connect **VM** probe **Control Line** at **Pin Number** indicated in **Table 3J-3**. (See **Figure 3J-2. A5J5 Signal Locator**.)

**Table 3J-3. A5J5 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 6 and 11) | **Pin Number** (Step 7) |
|---|---|---|---|
| 1 | SUM CLK | [4] [4] [HZ] | 16 |
| 2 | SUM DATA | [4] [5] [HZ] | 18 |

**Figure 3J-2. ASJ5 Signal Locator**
**(Solder-Side View)**




8 [2] [5] [HZ]
(To enable voltmeter.)
9. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
([5] [HZ] to repeat measurement.)

## A12 MODULE DIAGNOSTICS

**Check Low State**

10. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)

**NOTE**

A "**1**" will appear in display indicating that the data bits will be set high. However, the bits are inverted in the Control Section before they are sent to **A12**.

11. Enter **Bit Select Keys**, as indicated in **Table 3J-3. A5J5 Control Bits**, for same **Control Line.**
12. **[2] [5] [HZ]**
    (To enable voltmeter.)
13. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

**<u>Divider Control Lines</u>**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To set bit high)

**NOTE**

This bit is not inverted in the Control Section before it is sent to A 12.

15. Enter **Bit Select Keys**, as indicated in **Table 3J-4. A5J5 Control Bits**, for **Control Line** to be tested.
16. Connect **VM** probe **Control Line** at **PIN NUMBER** indicated in **Table 3J-4.** (See **Figure 3J-2. A5J5 Signal Locator.**)

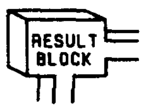
**Table 3J-4. A5J5 Control Bits**

| Test Order | Control Line | Bit Select Keys (Steps 15 and 20) | Pin Number (Step 16) |
|---|---|---|---|
| 1 | DIV 0 | [2] (7) [HZ] | 20 |
| 2 | DIV 1 | [2] [8] [HZ] | 22 |
| 3 | DIV 2 | [2] (9) [HZ] | 24 |

17. [2] [5] [HZ]
    (To enable voltmeter.)
18. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
    ([5] [HZ] to repeat message.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To set bit low.)
20. Enter **Bit Select Keys**, as indicated in **Table 3J-4. A5J5 Control Bits**, for same **Control Line.**
21 [2] [5] [HZ]
    (To enable voltmeter.)
22. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)
23. Record test results.
24. Reconnect **W5** and lower **Module** back into instrument.
25. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W5 CTL LINES.**



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A12.07** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |


Internal Voltmeter **(VM)** is used to check power supply levels at inputs to **A12 Module.**

**<u>Run Test</u>**

1. Switch instrument to Standby:

   **NOTE**

   A 12 Module must be lifted slightly to disconnect W5. Release module retaining clips (at each end of module) from slide posts. Lift module up high enough to disconnect W5.

   - Disconnect **W5** from **A12 at A12A3 J1.**
   - Plug end of **W5 <u>into</u> 26** pin test connector, from On-Site Service Kit.

   **NOTE**

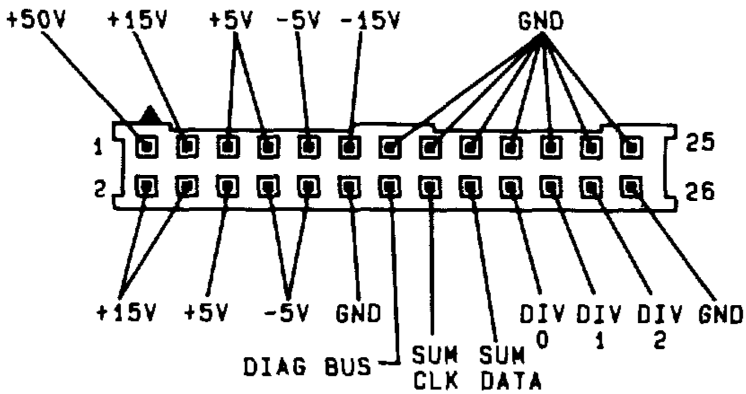
   Find arrowhead on test connector and align with arrowhead on cable plug **W5P2**.

2. Connect VM probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1)**. (See **A12 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

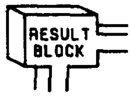
3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

4. Measure voltage levels:
   - Connect **VM** probe to test connector pin for each power supply line (see **Figure 3J-3**. **Cable Plug WSP2 Signal Locator).**
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3J-3. Cable Plug WSP2 Signal Locator**




5. Record test results.
6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST Vdc.**



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A12.08** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |


Internal Voltmeter **(VM)** is used to check power supply levels at **A5J5.**

**Run Test**

1. Switch instrument to Standby.
2. Extend **A12 Module** on extender posts, from On-Site Service Kit to disconnect cable **WS** from **A5** Assembly at **A5J5.** (See table on foldout in **MECHANICAL PROCEDURES** to locate **A12 Module** extension and **A5** cable disconnection information.)

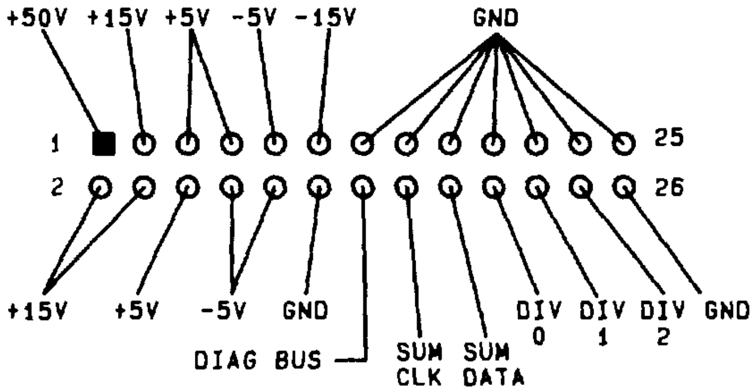
**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W5.**

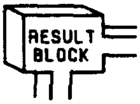
3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A12 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)
4. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)
5. Measure voltage levels at A5J5:
   - Access signals from solder-side of **A5J5**. (See **Figure 3-4**. **A5J5 Signal Locator**.)
     [5] [HZ] (To make each voltage measurement.)

## A12 MODULE DIAGNOSTICS

**Figure 3J-4. A5J5 Signal Locator**
**(Solder-Side View)**




6. Record test results.
7. Reconnect W5 and lower Module back into instrument.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W5 PS LINES.**



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Loop Lock/Unlock | **A12.09** |
| **Run time:** | 40 sec. | |
| **Set-up time:** | 0 | |


### Run Test

1. [INSTR PRESET] [SHIFT]
   Hold shift key until “**100.000000MZ  -140.0DM**" appears, to override 20 second reset test.)

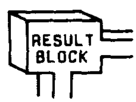
2. [SHIFT]  [SPCL] [3] [3] [4] [1] [HZ]

3. When **"DIAG DONE  HIT MSSG .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A12.**

**NOTE**

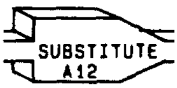
If any error codes are displayed for modules A01 - A11, you need to isolate those failure(s) before performing the A12 MODULE SLUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST A12 MODULE.**



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A12.10** |
| **Run time:** | 10 sec. | |
| **Set-up time:** | 5 min. | |




The following describes the technique for connecting a known good A 12 Module without removing the A12 Module in the instrument.

### Connect Substitute Module

1. Switch instrument to **Standby.**
2. Disconnect cables **W5, W30 W31** and **W33** from A12 Module (see **A12 MODULE CABLE CONNECTION LOCATOR** on foldout).
3. Without removing **A12 Module** from instrument, carefully lay substitute A12 Module on top of modules **A7, A9** and **A11.**

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

4. Connect cables **W5, W30, W31** and **W33** to substitute module.

### Down-Load Cal Data

**CAUTION**

Use adequate Electrostatic Discharge Techniques when handling the A20 Calibration Module.

5. Remove from On-Site Service Kit, **A20 Calibration Module** provided for substitute A12 Module.

## A12 MODULE DIAGNOSTICS

**CAUTION**

Check that switch S1 on A20 Module is switched up to its "**PROTECTED**" position.

6. With instrument switched to **Standby,** connect **A20 Module** to **A3 Module** at **A3J3** (see **A12 MODJULE CABLE CONNECTION LOCATOR** on foldout).

7. Turn instrument on.

8. When "**100.000000MZ -140.00 DM**" appears:
   - Slide switch on left side of **A3S2** on **A3 Module** back toward rear of instrument (see **A12 MODULE CABLE CONNECTION LOCATOR** on foldout).

9. [SHIFT] [SPCL] [3] [7] [3] [2].[HZ]

10. When "TRANSFER VERIFIED . **U613"** appears:
    - Slide **A3S2** forward toward front of instrument to protect **A3 Module's** memory.

11. Switch Instrument to **Standby** and remove **A20 Module**. Replace **A20 Module.** in On-Site Service Kit.

12. Return to foldout.

## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A12.11** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 0 | |


Test operation of substitute A12 Module by repeating test performed on A12 Module before substitution.

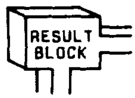
**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM"** to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [4] [1] [HZ]

3. When "**DIAG DONE  HIT MSSG V1**" appears:
   - Use t MSSG I to scroll through messages.
   - Record error code(s) displayed for A 12

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A12.**



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A 12 Tests | **A12.12** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |


**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

The A12 failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1:** **Instrument Level Self Test** indicated **A12** failure.
**Condition 2:** **A13 Module RF Power Test** indicated **A12** failure.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A12** failure.

**Condition 1**

1. INSTR PRESET: SHIFT
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].
3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to "**FM/ΦM INPUT**' (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT".**
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue.
4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record **A 12** error codes.

**NOTE**

If any error codes are displayed for modules A01 - A11, you need to isolate those failure(s) before performing the A12 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.) 5. Return to foldout.

5. Return to foldout.

## A 12 MODULE DIAGNOSTICS

**Condition 2**

1. INSIR PRESET SHIFT
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [4] [5] [HZ]

3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect cable **W31** from module at **A12A2 J2**.
   - Connect **YELLOW PM** cable and adapter to cable **W31.**
   - [HZ] to continue test.

4. When "**WAITING FOR SET-UP 2 .V25**" appears:
   - Reconnect cable **W31** to module at **A12A2 J2.**
   - Disconnect cable **W30** from module at **A12A3J6**.
   - Connect **PM** cable and adapter to **W30.**
   - [HZ] to continue test.

5. When "**WAITING FOR SET-UP 3 .V26**" appears:
   - Reconnect cable **W30** to module at **A12A3 J6**.
   - Disconnect cable **W32** from module at **A12A3 J3**.
   - Connect **PM** cable to module at **A12A3J3**.
   - [HZ] to continue test.

6. When "**RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W32** to module at **A12A3 J3**.
   - [HZ] to continue test.

7. When "**DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A12**.
8. Return to foldout.

**Condition 3**

1. Set instrument to operating condition which causes **A12 failure**.
2. Record instrument set-up and error message(s).
3. Return to foldout.

## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute A 12 Tests | **A12.13** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

Test operation of substitute **A12 Module** by repeating test(s) performed on **A12 Module** before substitution.

**Condition 1:** **Instrument Level Self Test** indicated **A12** failure.
**Condition 2:** **A13 Module RF Power Test** indicated **A12** failure.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A12** failure.

**<u>Condition 1</u>**

1. INSTR PRESET SHIFT
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.

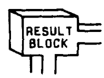
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].

3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector from On-Site Service Kit, to "**FM/ΦM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPU**T".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue.

4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record **A12** error codes.

**NOTE**

If any error codes are displayed for modules A01 - A11,. you need to isolate those failure(s) now.

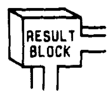
5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each 

   for TEST **SUB A12 FURTHER.**

## A12 MODULE DIAGNOSTICS

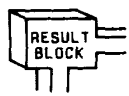
**Condition 2**

1. INSTR PRESET SHIFT)
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [3] [4] [5] [HZ]
3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect cable W31 from module at A12A2 J2.
   - Connect **YELLOW PM** cable and adapter to cable W31
   - [HZ] to continue test.
4. When "**WAITING FOR SET-UP 2 .V25**" appears:
   - Reconnect cable **W31** to module at A12A2 J2.
   - Disconnect cable W30 from module at A12A3 J6.
   - Connect **PM** cable and adapter to **W30.**
   - [HZ] to continue test.
5. When "**WAITING FOR SET-UP 3**. **V26**" appears:
   - Reconnect cable W30 to module at A12A3 J6.
   - Disconnect cable W32 from module at A12A3 J3.
   - Connect PM cable to module at A12A3 J3.
   - [HZ] to continue test.
6. When "**RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W32** to module at **A12A3 J3.**
   - [HZ] to continue test.
7. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use I MSSG I to scroll through messages.
   - Record error code(s) displayed for A12,.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A12 FURTHER**.




**Condition 3**

1. Set instrument to operating condition which causes **A12** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A12 FURTHER**.



## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Replacement | **A12.14** |
| **Run time** | 10 sec. | |
| **Set-up time:** | 5 min. | |


### Connect Module

1. Switch instrument to Standby.
2. Disconnect cables **W5, W30, W31** and **W33** from substitute **A 12 Module.**

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

3. Reconnect cables **W5**, **W30**, **W31** and **W33** to **A12 Module**.
4. Return **substitute A12 Module** to On-Site Service Kit.

### Down-Load Cal Data

**CAUTION**

Use adequate Electrostatic Discharge Techniques when handling the A20 Calibration Module.

5. After making sure that **A20 Module** for substitute A12 Module has been returned to On-Site Service Kit, remove **A20 Calibration Module** from Rear Panel (see **MECHANICAL PROCEDURES** for removal information).

## A12 MODULE DIAGNOSTICS

**CAUTION**

Check that switch S1 on A20 Module is switched up to its "**PROTECTED**" position.

6. With instrument switched to **Standby**, connect **A20 Module** to **A3 Module** at **A3J3.**

7. Turn instrument on.

8. When "**100.000000 MZ -140.00 DM**" appears:
   - Slide switch on left side of **A3S2** on **A3 Module** back toward rear of instrument.

9. [SHIFT] [SPCL] [3] [7] [3] [2] [HZ]

10. When "**TRANSFER VERIFIED.** .**U613"** appears:
    - Slide A3S2 forward toward front of instrument to protect **A3 Module's** memory.

11. Switch Instrument to **Standby** and remove **A20 Module**. **Replace A20 Module** on **Rear Panel.**

12. Return to foldout.

## A12 MODULE DIAGNOSTICS

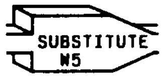
| | | |
|---|---|---|
| **Type:** | Cable Connection | **A12.15** |
| **Run time:** | 5 min. | |
| **Set-up time:** | 1 min. | |


1. Testing has shown **W30** or **W31** to be suspect, temporarily replace it with a test cable from the On-Site Service Kit. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

2. Deleted.

3. Return to foldout.

## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A12.16** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 3. Min. |  |



Testing has shown cable **W5** to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

**CAUTION**

When connecting ribbon cable to A12 Module, find arrowhead on the cable plug and align with arrow-head on the board connector.

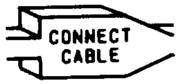
**Reconnect W5**

1. Switch instrument to Standby to connect cable **W5** to **A5 Assembly** and **A12 Module**. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on connecting cable **W5** to **A5J5**.)

2. Return to foldout.

## A12 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A12.17** |
| **Run time:** | 6 min. | |
| **Set-up time:** | 8. Min. | |




**CAUTION**

When connecting ribbon cable to A12 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W5**

1. Switch instrument to **Standby** to reconnect cable **W5** to **A5 Assembly** or **A12 Module**. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on reconnecting cable **W5** to **A5J5**.)

2. Return to foldout.

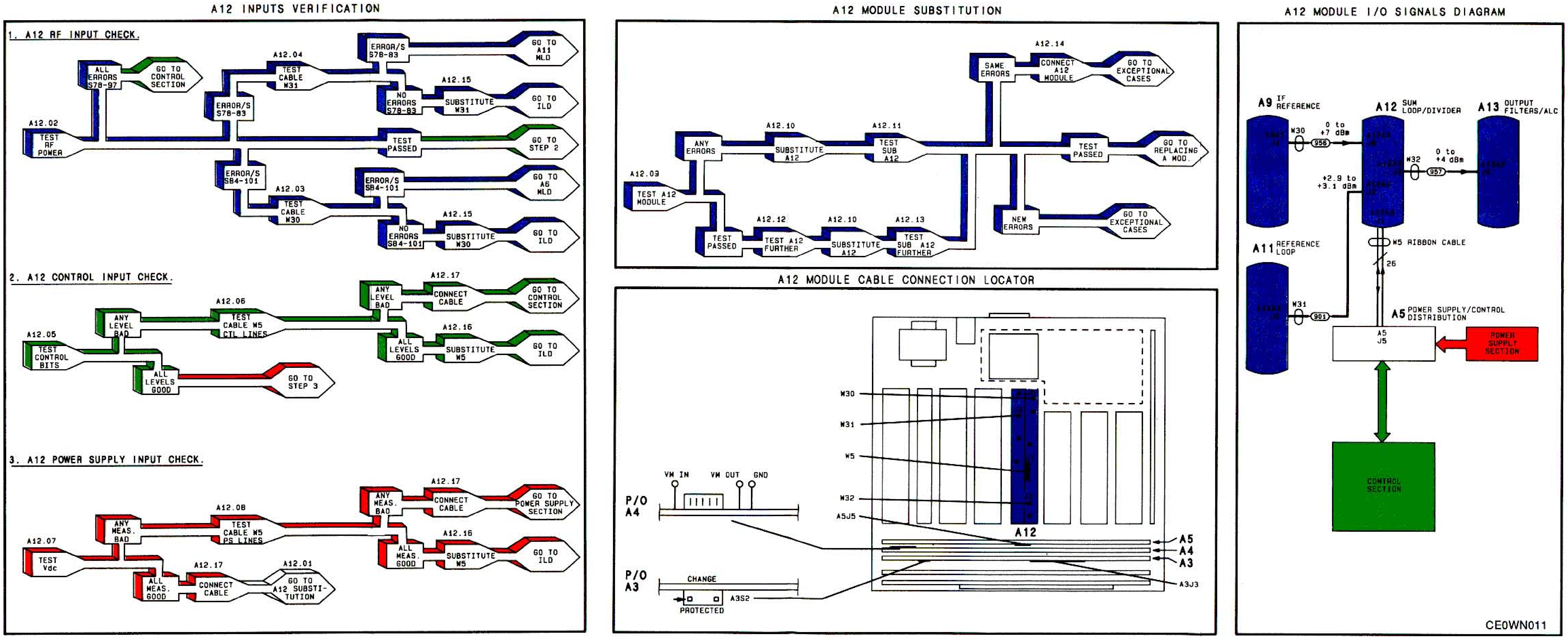



Figure 3J-100. A12 Sum Loop/Divider Module Diagnostics.

## A13 OUTPUT FILTERS/ALC MODULE

### 3K-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A13 Module**. The objective is to isolate the failure indicated for this module the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01 - A12**. (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or .74 ft-lbs (slightly tighter than finger tight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptible to short circuiting.

### Test Instructions

1. The instrument's Top Cover must be removed to run many of these tests. (Refer to the table shown on the foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. The last page in this group of tests is a foldout and should be pulled out now.

3. Turn to the next page to begin the **A13 MLD**.

## A13 MODULE SUBSTITUTION

### 3K-2. INTRODUCTION

**NOTE**

If a known good module is not available, proceed to the next page **A13 INPUTS VERIFICATION**.

The first step in isolating an **A13** failure is to substitute in a known good module from The On-site Service Kit.

**<u>A13 Substitution Instructions</u>**

1. Find **A13 MODULE SUBSTITUTION** on the foldout.

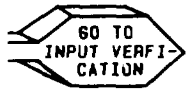
2. Use the Task Sequence Diagram, shown under **A13 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they appear in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A13 INPUTS VERIFICATION

**A13.01**




### 3K-3. INTRODUCTION

If a known good **A13 Module** is not available or if you were not able to isolate the failure using the **A13 MODULE SUBSTITUTION** procedure, the Task Sequence Diagrams (shown under **A13 INPUTS VERIFICATION**) should be used to check each signal path into the A13 Module.

**A13 Inputs Verification Instructions**

1. Find **A13 INPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown **under A13 INPUTS VERIFICATION**, are separated into three checks: **RF, Control** and **Power** Supply signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they appear in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under **1. A13 RF INPUT CHECK**.

**NOTE**

The **A13 MODULE I/O SIGNALS DIAGRAM** shows all parts which the **A13 Module** depends on for operation.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1;Loop Lock/Unlock | **A13.02** |
| **Run time:** | 30 sec. | |
| **Set-up time:** | 0 | |


### Run Test

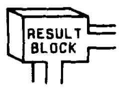
1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [5] [1] [HZ]

3. When "**DIAG DONE HIT MSSG .V1**" appears:
   - Use -[MSSG] to scroll through messages.
   - Record error code(s) displayed for A13. If "**TEST 1 OF A13** (**PASSED** or **FAILED**)'" is not displayed, rerun test.

**NOTE**

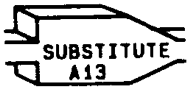
If any error codes are displayed for modules A01 - A12, you need to isolate those failure(s) before performing the A13 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

   for **TEST A13 MODULE**.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A13.03** |
| **Run time:** | 0 | |
| **Set-up time:** | 5 min. | |




The following describes the technique for connecting a known good A13 Module without removing the A13 Module in the instrument.

**Connect Substitute Module**

1. Switch instrument to **Standby**.
2. Disconnect cables **W6, W2, W32** and **W34** from **A13** Module (see **A13 MODULE CABLE CONNECTION LOCATOR** on foldout).
3. Without removing **A13 Module** from instrument, carefully lay substitute **A13** Module on top of modules **A9, A11** and **A12**.

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

4. Connect cables **W6, W22**, and **W32** to substitute module.
5. Substitute a flexible coax cable, SMC-to-SMA adapters, and barrel adapters from On-Site Service Kit for cable **W34**, to connect output of substitute module to **A14 Module**.
6. Turn instrument on.
7. Return to foldout.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module | **A13.04** |
| **Run time:** | 1 min | |
| **Set-up time:** | 0 | |

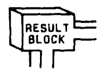

Test operation of substitute **A13 Module** by repeating test performed on A13 Module before substitution.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [4] [9] [HZ].

3. When "**DIAG DONE HIT MSSG .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A13**. If "**TEST 1 OF A13 (PASSED** OR **FAILED)"** is not displayed, rerun test.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each  for **TEST SUB A13.**

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A13 Tests | **A13.05** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional |  |

**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

The A13 failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1:** **Instrument Level Self Test** indicated **A13** failure.
**Condition 2:** **A14 Module RF Power Test** indicated **A13** failure.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A13** failure.

**<u>Condition 1</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.0000000MZ-140.0DM**" appears, to override 20 second reset test.
2. [SHIFT] [SPCL] [3] [0] [HZ]
3. When **"WAITING FOR SET-UP 1. V24**" appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to "**FM/FM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ]to continue.
4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record **A13** error codes.

**NOTE**

If any error codes are displayed for modules A01 - A12, you need to isolate those failure(s) before performing the A13 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

5. Return to foldout.

**Condition 2**

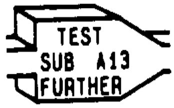
1. (INSIR PRESET) [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [5] [1] [HZ]
3. When "**WAITING FOR SET-UP 1. V24"** appears:
   - Disconnect cable **W32** from module at **A13A2 J6.**
   - Connect **YELLOW PM** cable and adapter to cable **W32**.
   - [HZ] to continue test.
4. When "**WAITING FOR SET-UP 2 .V25**" appears:
   - Reconnect cable **W32** to module at **A13A2 J6.**
   - Disconnect cable **W34** from module at **A13A2 J3.**
   - Connect **PM** cable, SMC-to-SMA adapter and barrel adapter from On-Site Service Kit to module at **A13A2 J3.**
   - [HZ] to continue test.
5. When "**RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable W34 to module at **A13A2 J3**.
   - [HZ]M to continue test.
6. When "**DIAG DONE  HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A13.**
7. Return to foldout.

**Condition 3**

1. Set instrument to operating condition which causes **A13** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout.

## A13 MODUI.E DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute A 13 Tests | **A13.06** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |




**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

Test operation of **substitute A13 Module** by repeating test(s) performed on A13 Module before substitution.

**Condition 1:** **Instrument Level Self Test** indicated **A13** failure.
**Condition 2:** **A14 Module RF Power Test** indicated **A13** failure.
**Condition 3:** Instrument must be set to a specific operating condition to detect **A13** failure.

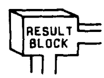
**Condition 1**

1. [INSTR PRESET] [SHIFT]
   Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second reset test.
2. [SHIFT] [SPCL] [3] [3] [0] [HZ]
3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Connect BNC Tee connector from On-Site Service Kit, to "**FM/ΦM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue.
4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record A13 error codes.

**NOTE**

If any error codes are displayed for modules A01 - A12, you need to isolate those failure(s) now.

5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A13 FURTHER.**

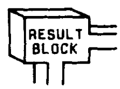


## A13 MODUILE DIAGNOSTICS

**Condition 2**

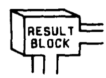
1. (INSTR) PRESET) [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second test.)
2. [SHIFT] [SPCL] [3] [3] [5] [1] [HZ]
3. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect cable W32 from module at **A13A2 J6**.
   - Connect YELLOW PM cable and adapter to cable **W32.**
   - [HZ] to continue test.
4. When "**WAITING FOR SET-UP 2 .V25**" appears:
   - Reconnect cable **W32** to module at **A13A2 J6**.
   - Disconnect cable **W34** from module at **A13A2 J3**.
   - Connect **PM** cable and adapters to module at **A13A2 J3**.
   - [HZ] to continue test.
5. When "**RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W34** to module at **A13A2 J3.**
   - [HZ] to continue test.
6. When "**DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A13.**

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A13 FURTHER.**




**Condition 3**

1. Set instrument to operating condition which causes **A13 failure**.
2. Record instrument set-up error message(s).
3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A13 FURTHER**.



## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A13.07** |
| **Run time:** | 0 | |
| **Set-up time:** | 5 min. | |


**Connect Module**

1. Switch instrument to Standby.

2. Disconnect cables **W6, W22, W32** and substitute output cable from substitute **A13 Module.**

**CAUTION**

When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

3. Reconnect cables **W6**, **W22**, **W32** and **W34** to **A13 Module**.

4. Turn instrument on.

5. Return substitute A 3 Module to On-Site Service Kit.

6. Return to foldout.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A;RF Power Levels | **A13.08** |
| **Run time:** | 1 min. 30 sec. | |
| **Set-up time:** | 2 min. | |


**RF** signal level is measured using Internal Power Meter (**PM**).

**CAUTION**

Do not permit end of Internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

**Run Test**

1. (INSRT) (PRESET) [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second test)

2. [SHIFT] [SPCL] [3] [6] (8) [1] [2] [HZ]
   (To check Input levels only.)

3. [3] [5] [1] [HZ]

4. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect cable **W32** from module at **A13A2 J6**.
   - Connect **YELLOW PM** cable and adapter to cable **W32.**
   - [HZ] to continue test.

5. When "**RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W32** to module at **A13A2 J6.**
   - [HZ] to continue test.

6. When "**DIAG DONE  HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A13.**

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST RF POWER**.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A;RF Power Levels | **A13.09** |
| **Run time:** | 1 min. 30 sec. |  |
| **Set-up time:** | 2 min. | |

**RF** signal level is measured using Internal Power Meter (**PM**).

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until "**100.000000MZ -140.0DM**" appears, to override 20 second test.)

2. [SHIFT] [SPCL] [3] [6] [8] [1] [2] [HZ]
   (To check input levels only.)

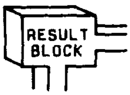
3. [3] [5] [1] [HZ]

4. When "**WAITING FOR SET-UP 1 .V24**" appears:
   - Disconnect cable **W32** from **A12** Module at **A12A3 J3**.
     (See Top View Diagram inside **Top Cover** to locate **W32** connection on **A12 Module**.)
   - Connect **YELLOW PM** cable to module at **A12A3J3**.
   - CM to continue test.

5. When "**RECONNECT ALL CABLES .V29**" appears:
   - Reconnect cable **W32** to module at **A12A3J3**.
   - [HZ] to continue test.

6. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A13**.

7. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each
     for **TEST CABLE W32**.



## A3 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3;Bit Transmission | **A13.10** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter (**VM)** is used to measure TTL level changes transmitted to **A13 Module** on Clock and Data control lines.

**Run Test**

1. Switch instrument to **Standby**:
   - Disconnect cable W6 from module at **A13A2 J1**.
   - Plug end of **W6** into **16 pin** test connector, from On-Site Service Kit.

   **NOTE**
   Find arrowhead on test connector and align with arrowhead on cable plug **W6P2.**

   **CAUTION**
   To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit..

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to VM IN (A4TP1). (See **A13 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

3. Turn instrument on.
   (Hold shift key until "**100.000000MZ -140.00DM**" appears, to override 20 second reset test.)

## A13 MODULE DIAGNOSTICS

### Clock Line

### Check High State

4. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state.)

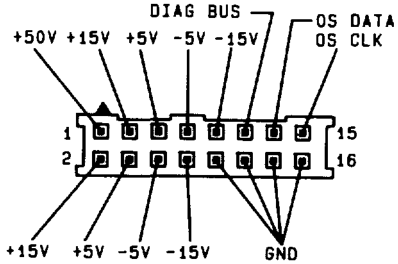
**NOTE**

A "**0**" will appear In display indicating that the data bit will be set low. However, the bit is inverted in the Control Section before it Is sent to **A13**.

5. [4] [0] [HZ]
   (To select bit.)

6. Connect **VM** probe to test connector line **OS CLK** (pin **15**). (See **Figure 3K-1**, **Cable plug W6PZ Signal Locator.)**

**Figure 3K-1, Cable Plug W6P2 Signal Locator**




7. [2] [5] [HZ]
   (To enable voltmeter.)

8. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
   ([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify low state.)

**NOTE**

A "**1**" will appear in display indicating that the data bit will be set high. However, the bit is inverted in the Control Section before it is sent to **A13**.

10. [4] [0] [HZ]
    (To select bit.)

11. [2] [5] [HZ]
    To enable voltmeter.)

12. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

**<u>Data Line</u>**

**Check High State**

13. [SHIFT] [SPCL]
    (To specify high state.)

14. [4] [1] [HZ]
    (To select bit.)

15. Connect **VM** probe to test connector line **OS DATA** (pin **13**). **(See Figure 3K-1. Cable Plug W6P2 Signal Locator.)**

16. [2] [5] [HZ]
    (To enable voltmeter.)

17. Voltage should read approximately **+2.5** to **+5.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

## A13 MODULE DIAGNOSTICS

### Check Low State

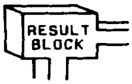
18. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)

19. [4] [1] [HZ]
    (To select bit.)

20. [2] [5] [5] [HZ]
    (To enable voltmeter.)

21. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

22. Record test results.

23. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each  for **TEST CONTROL BITS**.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit Transmission | **A13.11** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |


Internal Voltmeter (**VM**) is used to measure TTL level changes transmitted to **A13 Module** on Clock and Data control lines.

### <u>Run Test</u>

1. Switch instrument to **Standby.**

2. Extend **A13 Module** on extender posts, from On-Site Service Kit. to disconnect cable **W6** from **A5** Assembly at **A5J6**. (See table on foldout in **MECHANICAL PROCEDURES** to locate **A13 Module** extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W6**.

3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1)**. (See **A13 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)

4. Turn instrument on.

### <u>Clock Line</u>

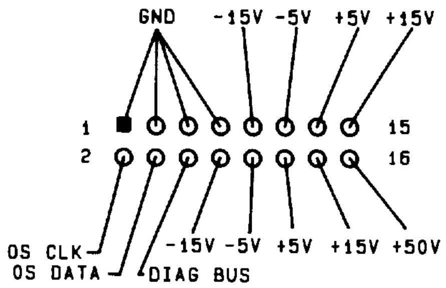
#### Check High State

5. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state.)

6. [4] [0] [HZ]
   (To select bit.)

7. Connect **VM** probe to solder-side of **A5J6** line **OS CLK** (pin **2**). (See **Figure 3K-2**. **A5J6 Signal Locator**.)

**Figure 3K-2. A5J6 Signal Locator**
**(Solder-Side view)**




8. [2] [5] [HZ]
   (To enable voltmeter.)
9. Voltage should read approximately **+2.5** to +**5.5 Vdc**
   ([5] HZ] to repeat measurement.)

**Check Low State**

10. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state).
11. [4] [0] [HZ]
    (To select bit)
12. [2] [5] [HZ]
    (To enable voltmemeter.)
13. Voltage should read approximately **-0.5** to +**1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

**Data Line**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To specify high state.)
15. [4] [1] [HZ]
    (To select bit.)

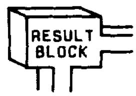
## A13 MODULE DIAGNOSTICS

16. Connect **VM** probe to solder-side of **A5J6** line **OS DATA** (pin **4**). (**See Figure 3K-2. A5J6 Signal Locator.)**
17. [2] [5] [HZ] (To enable voltmeter.)
18. Voltage should read approximately **+2.5** to +**5.5 Vdc**

[5] [HZ] to repeat measurement.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [1] To specify low state.)
20. [4] [1] [HZ] (To select bit).
21. [2] [5] [HZ]
22. Voltage should read approximately **-0.5 to +1.5 Vdc**
    **(**[5] [HZ] to repeat measurement.)
23. Record test results.
24. Reconnect **W6** and lower Module back into instrument.
25. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W6 CTL LINES**.



## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A13.12** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter (**VM**) is used to check power supply levels at inputs to inputs to **A13 Module.**

**Run Test**

1. Switch instrument to Standby:
   - Disconnect **W6** from **A13** at **A13A 2 J1.**
   - Plug end of **W6** **into** **16 pin** test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W6P2.**

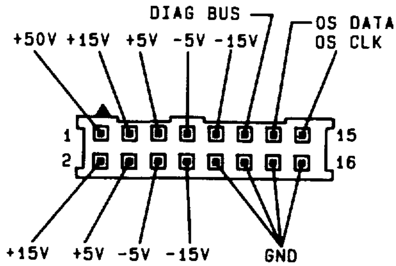
2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1**). (See **A13 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter)

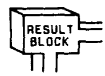
## A13 MODULE DIAGNOSTICS

4. Measure voltage levels:
   - Connect VM probe to test connector pin for each power supply line (see Figure **3K-3. Cable Plug W6P2 Signal Locator**).
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3K-3. Cable Plug W6P2 Signal Locator**

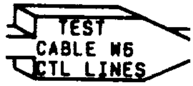



5. Record test results.

6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each  for **TEST Vdc.**

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A13.13** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 3 min. | |




Internal Voltmeter (**VM**) is used to check power supply levels at **A5J6**.

**<u>Run Test</u>**

1. Switch instrument to Standby.

2. Extend **A13 Module** on extender posts, from On-Site Service Kit. to disconnect cable **W6** from **A5 Assembly** at **A5J6**. {See table on foldout in **MECHANICAL PROCEDURES** to locate **A13 Module** extension and **A5** cable disconnection information.)

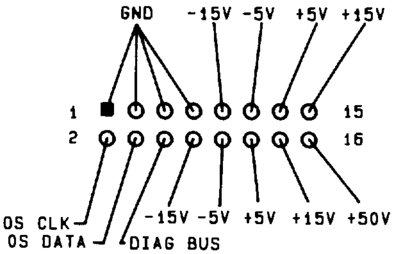
**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W6.**

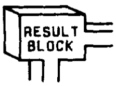
3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A13 MODULE CABLE CONNECTION LOCATOR** on foldout for **VM IN** location.)
4. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

5. Measure voltage levels at **A5J6:**
   - Access signals from solder-side of **A5J6.** (See **Figure 3K-4. AsJ6 Signal Locator**.)
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3K-4. A5J6 Signal Locator**
**(Solder-Side View)**




6. Record test results.
7. Reconnect **W6** and lower **Module** back into instrument.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W6 PS LINES**.



## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A13.14** |
| **Run time:** | 5 min. | |
| **Set-up time:** | 1 min. | |


1. Testing has shown cable **W32** to be suspect, temporarily replace with a test cable from the On-Site Service Kit. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD**) to confirm repair.

2. Deleted.

3. Return to foldout.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute | **A13.15** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |


Testing has shown cable **W6** to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT ILEVEL DIAGNOSTICS (ILD)** to confirm repair.

**CAUTION**

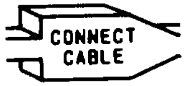
When connecting ribbon cable to A13 Module, find arrowhead on the cable plug and align with arrow-head on the board connector.

**Reconnect W6**

1. Switch instrument to **Standby** to connect cable **W6** to **A5 Assembly** and **A13 Module**. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on connecting cable **W6** to **A5J6**.)

2. Return to foldout.

## A13 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A13.16** |
| **Run time:** | 0 min. |  |
| **Set-up time:** | 3 min. | |

***CAUTION***

When connecting ribbon cable to A13 Module, find arrowhead on the cable plug and align with arrow-head on the board connector.

**<u>Reconnect W6</u>**

1. Switch instrument to **Standby** to reconnect cable **W6** to **A5 Assembly** or **A13 Module**. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on reconnecting cable **W6** to **A5J6**.)

2. Return to foldout.

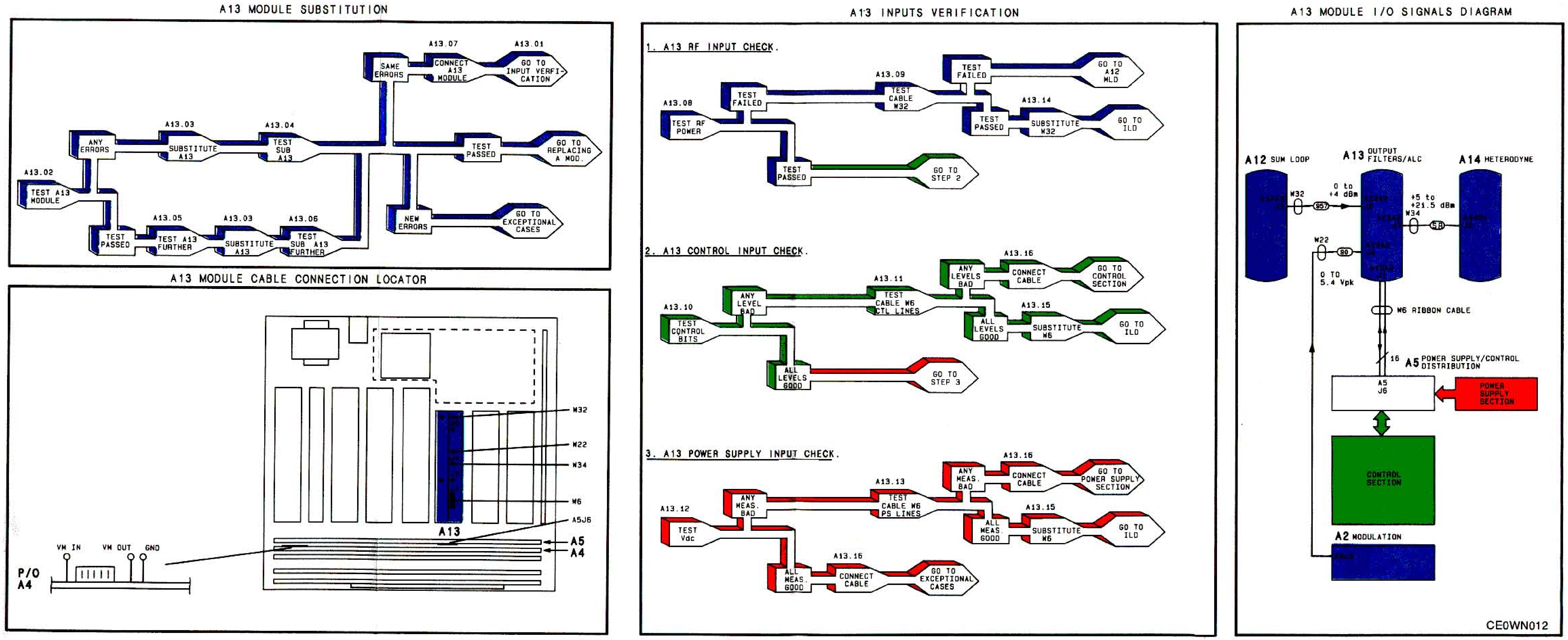



Figure 3K-100. A13 Output Filters/ALC Module Diagnostics.

## A14 HETERODYNE MODULE

### 3L-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A14 Module**. The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD**) showed no failures for modules **A01-A04** and **A07-A13**. (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 10 Nm or .74 ft-lbs (slightly tighter than finger tight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptible to short circuiting.

**Test Instructions**

1. The instrument's Top Cover must be removed to run many of these tests. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate instructions.)

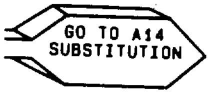
2. The last page in this group of tests is a foldout and should be pulled out now.

3. If you have been directed here to troubleshoot an **RF** power level failure, turn to page **3-4** to begin diagnostics, otherwise, proceed to the next page to begin the **A14 MLD**.

## A14 MODULE SUBSTITUTION

### 3L-2. INTRODUCTION

A14.01




**NOTE**

If a known good module is not available, proceed to the next page **A14 INPUTS VERIFICATION**.

**A14 Substitution Instructions**

1. Find **A14 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A14 MODULE SUBSTITUTION** to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A14 INPUTS VERIFICATION

### 3L-3. INTRODUCTION

A14.02


If a known good **A14 Module** is not available or if you were not able to isolate the failure using the **A14 MODULE SUBSTITUTION** procedure, the Task Sequence Diagrams (shown under **A14 INPUTS VERIFICATION**) should be used to check each signal path into the **A14 Module**.

**<u>A14 Inputs Verification Instructions</u>**

1. Find **A14 INPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown under **A14 INPUTS VERIFICATION**, are separated into three checks: **RF**, **Control** and **Power Supply** signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the page indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under **1. A14 RF INPUT CHECK**.

**NOTE**

The **A14 MODULE I/O SIGNALS DIAGRAM** shows all parts which the **A14 Module** depends on for operation.

## POWER LEVEL DIAGNOSTICS

### 3L-4. INTRODUCTION

The first step in isolating an **RF** power level failure is to check the power levels into and out of the **A14 Module**.

**Power Diagnostics Instructions**

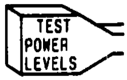
1. Find **A14 RF POWER LEVEL DIAGNOSTICS** on the foldout.

2. Use the Task Sequence Diagram, shown under **A14 RF POWER LEVEL DIAGNOSTICS**, to direct you through the testing process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the page indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A14.03** |
| **Run time:** | 1 min. 35 sec. |  |
| **Set-up time:** | 3 min. | |

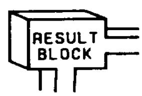
**RF** signal levels are measured using Internal Power Meter (**PM**).

**CAUTION**

Do not permit end of Internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

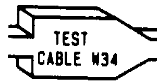
**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [5] [6] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W29** from **A14 Module** at **A14A2 J1.**
   - Connect **YELLOW PM** cable and adapter to cable **W29**.
   - [HZ] to continue test.
4. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W29** to module at **A14A2 J1.**
   - Disconnect cable **W34** from **A13 Module** at **A13A2 J3**.
   - Connect **PM** cable to **A13 Module** at **A13A2 J3** using adapter and barrel adapter from On-Site Service Kit.
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 3 .V26"** appears:
   - Reconnect cable **W34** to **A13 Module** at **A13A2 J3**.
   - Remove cable **W36** from **A14 Module** at **A14U1 J3** and **A19K1 J2**.
   - Connect **PM** cable to **A14 Module** at **A14U1 J3**.
   - [HZ] to continue test.
6. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W36** to **A14 Module** at **A14U1 J3** and **A19K1 J2.**
   - [HZ] to continue test.
7. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A14.**
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST POWER LEVELS.**



## A14 MODULE DIAGNOSTICS

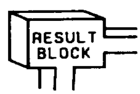
| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A14.04** |
| **Run time:** | 1 min.  35 sec. | |
| **Set-up time:** | 3 min. | |




Cable **W34** is tested by substituting in a test cable from the On-Site Service Kit.

**<u>Run Test</u>**

1. [INSTR PRESET]  [SHIFT]
   (Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT]  [SPCL]  [3]  [3]  [5]  [6]  [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W29** from **A14 Module** at **A14A2 J1**.
   - Connect **YELLOW PM** cable and adapter to cable **W29**.
   - [HZ] to continue test.
4. When **"WAITING FOR SET-UP 2  .V25"** appears:
   - Reconnect cable **W29** to module at **A14A2 J1**.
   - Disconnect cable **W34** from **A13** and **A14** modules at **A13A2 J3** and **A14U1 J3.**
   - Connect **PM** cable to **A13** Module at B using adapter and barrel adapter from On-Site Service Kit.
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 3 .V26"** appears:
   - Connect test cable (flexible) to **A13** and **A14** modules at **A13A2 J3** and **A14U1 J3.**
   - Remove cable **W36** from **A14 Module** at **A14U1 J3** and **A19K1J 2.**
   - Connect **PM** cable to **A14 Module** at **A14U1 J3.**
   - [HZ] to continue test.
6. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W36** to **A14 Module** at **A14U1 J3** and **A19K1 J2.**
   - [HZ] to continue test.
7. When **"DIAG DONE   HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A14**.
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W34**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Loop Lock/Unlock | **A14.05** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 0 | |


**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [2] [0] [HZ]
3. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A6**. If "**TEST 1 OF A06** (**PASSED** OR **FAILED**)" is not displayed, rerun test.

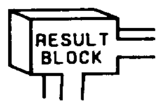
**NOTE**

The **A14 Module's** loop test is included in this **A6 Module** test.

**NOTE**

If any error codes are displayed for modules A01-A04 or A07-A13, you need to isolate those failure(s) before performing the A14 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST A14 MODULE**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A14.06** |
| **Run time:** | 0 | |
| **Set-up time:** | 5 min. |  |

The following describes the technique for connecting a known good A 14 Module.

**<u>Connect Substitute Module</u>**

1. Switch instrument to **Standby**.

2. Remove **A14 Module** and install substitute module (refer to table on foldout in **MECHANICAL PROCEDURES** to locate removal and replacement information.)

3. Turn instrument on.

4. Return to foldout.

## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A14.07** |
| **Run time:** | 1 min. |  |
| **Set-up time:** | 0 | |

This procedure tests operation of **substitute A14 Module** by repeating test performed on **A14 Module** before substitution.

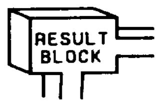
**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT] [SPCL] [3] [3] [2] [0] [HZ]

3. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A6**. If "**TEST 1 OF A06** (**PASSED** OR **FAILED**)" is not displayed, rerun test.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A14.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional A14 tests | **A14.08** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

The **A14** failure conditions for arriving t this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1:** **Instrument Level Self Test** indicated **A14** failure.
**Condition 2:** **A14 Module** failed **POWER LEVEL DIAGNOSTICS.**
**Condition 3:** Instrument must be set to a specific operating condition to detect **A14** failure.

**<u>Condition 1</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [0] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/fM INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.
4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record any A06 and A14 error codes.

**NOTE**

If any error codes are displayed for modules A01-A04 or A07-A13, you need to isolate those failure(s) before performing the A14 MODULE SUBSTITUTION. (Refer to INSTRUMENT LEVEL DIAGNOSTICS to determine correct order for troubleshooting modules.)

5. Return to foldout:

## A14 MODULE DIAGNOSTICS

**Condition 2**

1. Use results from **TEST RF POWER** to check substitute module.
2. Rerun test now if necessary to ensure all test results have been recorded accurately.
3. Return to foldout.

**Condition 3**

1. Set instrument to operating condition which causes **A14** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout.

| | | |
|---|---|---|
| **Type:** | Additional Substitute A14 tests | **A14.09** |
| **Run time:** | Conditional | |
| **Set-up time:** | Conditional | |


This procedure tests operation of substitute **A14 Module** by repeating test(s) performed on **A14 Module** before substitution.

**Condition 1:** **Instrument Level Self Test** indicated **A14** failure.
**Condition 2:** **A14 Module** failed **POWER LEVEL DIAGNOSTICS.**
**Condition 3:** Instrument must be set to a specific operating condition to detect **A14** failure.

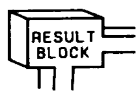
<u>**Condition 1**</u>

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [0] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/fM INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.
4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record **A06** and **A14** error codes.

**NOTE**

If any error codes are displayed for modules A01-A04 or A07-A13, you need to isolate those failure(s) now.

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A14 FURTHER.**



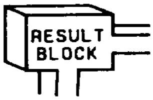
## A14 MODULE DIAGNOSTICS

**Condition 2**

1. Use results from **A14.03** to check substitute module.

2. Rerun test now if necessary to ensure all test results have been recorded accurately.

3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A14 FURTHER.**

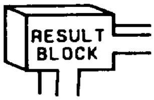



**Condition 3**

1. Set instrument to operating condition which causes **A14** failure.

2. Record instrument set-up and error message(s).

3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A14 FURTHER.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A14.10** |
| **Run time:** | 0 |  |
| **Set-up time:** | 5 min. | |

**Connect Module**

1. Switch instrument to **Standby.**

2. Disconnect cables **W7, W29, W34** and **W36** from substitute **A14 Module.**

3. Return substitute A14 Module to On-Site Service Kit.

**CAUTION**
When connecting ribbon cable, find arrowhead on cable connector and align with arrowhead on board connector.

4. Reconnect **W7** to module at **A14A3 J6** and lower module back into instrument.

5. Reconnect cables **W7, W29, W34** and **W36** to **A14 Module.**

6. Turn instrument on.

7. Return to foldout.

| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A14.11** |
| **Run time:** | 1 min. | |
| **Set-up time:** | 2 min. |  |



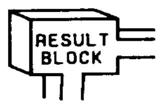
RF signal level is measured using Internal Power Meter (PM).

**<u>CAUTION</u>**

Do not permit end of Internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

**<u>Run Test</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] **[8]** [1] [3] [HZ]
3. [3] [5] [6] [HZ]
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W29** from **A14 Module** at **A14A2 J1**.
   - Connect **YELLOW PM** cable and adapter to cable **W29**.
   - [HZ] to continue test.
5. When **"WAITING FOR SET-UP 2 .V25"** appears:
   - Reconnect cable **W29** to module at **A14A2 J1**.
   - Disconnect cable **W34** from **A13 Module** at **A13A2 J3.**
   - Connect **PM** cable to **A13 Module** at **A13A2 J3** using adapter and barrel adapter from On-Site Service Kit.
   - [HZ] to continue test.
6. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W34** to module at **A14A2 J3.**
   - [HZ] to continue test.
7. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A14.**
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST RF POWER.**

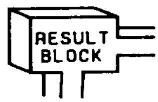


| | | |
|---|---|---|
| **Type:** | 2A; RF Power Levels | **A14.12** |
| **Run time:** | 10 sec. | |
| **Set-up time:** | 1 min. | |


**RF** signal level is measured using Internal Power Meter **(PM).**

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [6] **[8]** [1] [2] [HZ]
3. [3] [5] [6] [HZ]
4. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Disconnect cable **W29** from **A6 module** at **A6A2 J9.** (See Top View Diagram inside **Top Cover** to locate **W29** connection on **A6 Module).**
   - Connect **YELLOW PM** cable and adapter to **A6 module** at **A6A2 J9.**
   - [HZ] to continue test.
5. When **"RECONNECT ALL CABLES .V29"** appears:
   - Reconnect cable **W29** to **A6 Module** at **A6A2 J9.**
   - [HZ] to continue test.
6. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A14.**
8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W29.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute | **A14.13** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |

Internal Voltmeter (**VM**) is used to measure TTL level changes transmitted to **A14 Module** on MUX and Band select lines.

**<u>Run Test</u>**

1. Switch instrument to **Standby:**
   - Disconnect cable **W7** from module at **A14A2 J2.**
   - Plug end of **W7** **<u>into</u>** **16 pin** test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug W7P2.

**<u>CAUTION</u>**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A14 MODULE CABLE CONNECTION LOCATOR** on foldout for VM IN location.)

3. Turn instrument on.
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

## MUX and Band Select Lines

### Check High State

4. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify high state).

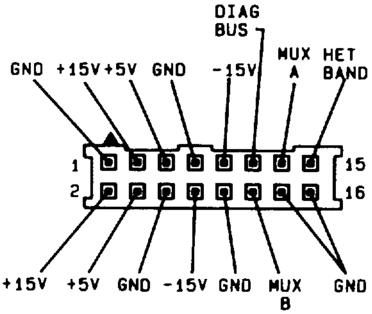
5. Enter **Bit Select Keys** as indicated in **Table 3L-1. W7P2 Control Bits**, for **Control Line** to be tested.

6. Connect **VM** probe to **Control Line** at **Pin Number** indicated in **Table 3L-1.** (See **Figure 3L-1. Cable Plug W7P2 Signal Locator**.)

**Table 3L-1. W7P2 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 5 and 10) | **Pin Number** (Step 6) |
|---|---|---|---|
| 1 | MUX A | [9] [HZ] | 12 |
| 2 | MUX B | [1] [1] [HZ] | 12 |
| 3 | HET BAND | [2] [6] [HZ] | 15 |

**Figure 3L-1. Cable Plug W7P2 Signal Locator**



7. [2] [5] [HZ]
   (To enable voltmeter).

8. Voltage should read approximately **+ 2.5** to **+ 5.5 Vdc**.
   ([5] [HZ] to repeat measurement).

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify low state.)

10. Enter Bit Select Keys as indicated in **Table 3L-1. W7P2 Control Bits**, for same **Control Line.**

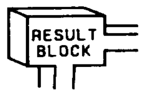
11. [2] [5] [HZ]
    (To enable voltmeter.)

12. Voltage should read approximately **- 0.5** to **+ 1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

13. Repeat Procedure for each **Control Line** shown in **Table 3L-1.**

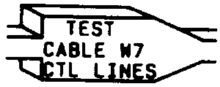
14. Record test results.

15. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CONTROL BITS.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 3; Bit transmission | **A14.14** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |




Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A14 Module** on MUX and Band select lines.

### <u>Run Test</u>

1. Switch instrument to **Standby**.

2. Extend **A14 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W7** from **A5 Assembly** at **A5J7.** (See table on foldout in **MECHANICAL PROCEDURES** to locate **A14 Module** extension and AS cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W7**.

3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A14 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

4. Turn instrument on.

**NOTE**

It is only necessary to perform this test on failing control line.

### <u>MUX and Band Select Lines</u>

**Check High State**

5. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify high state.)

6. Enter **Bit Select Keys** as indicated in **Table 3L-2. A5J7 Control Bits**, for **Control Line** to be tested.

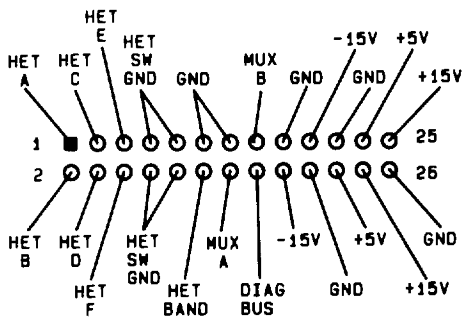
## A14 MODULE DIAGNOSTICS

7. Connect **VM** probe to **Control Line** at **Pin Number** indicated in **Table 3L-2.** (See **Figure 3L-2. ASJ7 Signal Locator.)**

**Table 3L-2. A5J7 Control Bits**

| **Test Order** | **Control Line** | **Bit Select Keys** (Steps 6 and 11) | **Pin Number** (Step 7) |
|---|---|---|---|
| 1 | MUX A | (9) [HZ] | 14 |
| 2 | MUX B | [1] [1] [HZ] | 15 |
| 3 | HET BAND | [2] [6] [HZ] | 12 |

**Figure 3L-2. A5J7 Signal Locator (Solder-Side View)**




8. [2] [5] [HZ]
(To enable voltmeter).

9. Voltage should read approximately **+ 2.5** to **+ 5.5 Vdc**.
([5] [HZ] to repeat measurement.)

## A14 MODULE DIAGNOSTICS

### Check Low State

10. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To specify low state.)

11. Enter **Bit Select Keys** as indicated in **Table 3L-2. A5J7 Control Bits**, for same **Control Line.**

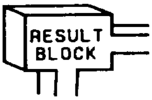
12. [2] [5] [HZ]
    (To enable voltmeter).

13. Voltage should read approximately **- 0.5** to **+ 1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

14. Record test results.

15. Reconnect **W7** and lower **Module** back into instrument.

16. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W7.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Driver Transmission | **A14.15** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 4 min. | |


Internal Voltmeter **(VM)** is used to measure level changes transmitted to **A14 Module** on **Switch Driver** control lines.

**Run Test**

1. Switch instrument to Standby:
   - **A14 Module** will have to be extended to access **A14A3 J6**. (See table on foldout in **MECHANICAL PROCEDURES** to locate module extension instructions.)
   - Disconnect cable **W7** from module at **A14A3 J6**.
   - Plug end of **W7** into 10 pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W7P3**.

**CAUTION**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A14 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

3. Turn instrument on.
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

**Check High State**

4. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state).

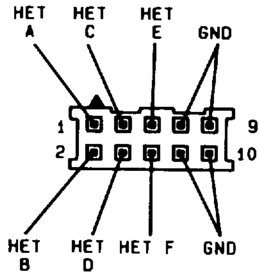
**NOTE**

A "**0**" will appear in display indicating that the data bit will be set low. However, the bit is inverted before it is sent to **A14**.

5. [7] [1] [HZ]
   (To select bits).

6. Connect **VM** probe to test connector **HET A** (pin **1**). (See **Figure 3L-3. Cable plug W7P3 Signal Locator.)**

**Figure 3L-3. Cable Plug W7P3 Signal Locator**




7. [2] [5] [HZ]
   (To enable voltmeter).

8. Voltage should read approximately **+ 20 Vdc**.

9. Check each driver line (pins **1-6**), by connecting VM probe to each pin and keying [5] [HZ]. Voltage should read approximately **+ 20 Vdc** on each line.

## A14 MODULE DIAGNOSTICS

### Check Low State

10. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)

**NOTE**

A "**1**" will appear in display indicating that the data bit will be set high. However, the bit is inverted before it is sent to **A14**.

11. [7] [1] [HZ]
    (To select bits)

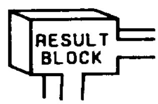
12. [2] [5] [HZ]
    (To enable voltmeter.)

13. Voltage should read approximately **0 Vdc**.
    ([5] [HZ] to repeat measurement.)

14. Check each driver line by connecting **VM** probe to each pin and keying [5] [HZ]. Voltage should read approximately **0 Vdc** on each line.

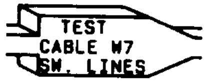
15. Record test results.

16. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST SWITCH DRIVE.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Driver Transmission | **A14.16** |
| **Run time:** | 3 min. | |
| **Set-up time:** | 3 min. | |




Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A14 Module Switch Driver** control lines.

### Run Test

1. Switch instrument to **Standby.**

2. Extend **A14 Module** on extender posts, from On-site Service Kit to disconnect cable **W7** from **A5 Assembly** at **A5J7**. (See table on foldout in **MECHANICAL PROCEDURES** to locate **A14 Module** extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W7**.

3. Connect VM probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A14 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

4. Turn instrument on.

### Check High State

5. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state.)

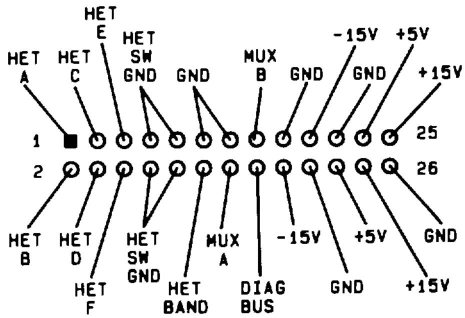
**NOTE**

A "**0**" will appear in display indicating that the data bit will be set low. However, the bit is inverted in the Control Section before it is sent to **A14**.

6. [7] [1] [HZ]
   (To select bit)

7. Connect **VM** probe to solder-side of **A5J7** line **HET A** (pin **1**). (See **Figure 3L-4. A5J7 Signal Locator.)**

**Figure 3L-4, A5J7 Signal Locator (Solder-Side View)**




8. [2] [5] [HZ]
   (To enable voltmeter.)

9. Voltage should read approximately **+20 Vdc**.

10. Check each driver line (pins **1-6**) by connecting **VM** probe to each pin and keying [5] [HZ].

Check Low State

11. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)

**NOTE**

A "**1**" will appear in display indicating that the data bit will be set high. However, the bit is inverted in the Control Section before it is sent to **A14**.

12. [7] [1] [HZ]
    (To select bit).

## A14 MODULE DIAGNOSTICS

13. Connect **VM** probe to solder-side of **A5J7** line **HET A** (pin **1**).

14. [2] [5] [HZ]
    (To enable voltmeter).

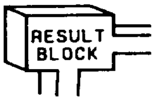
15. Voltage should read approximately **0 Vdc**.
    ([5] [HZ] to repeat measurement.)

16. Check each driver line (pins **1-6**).

17. Record test results.

18. Reconnect **W7** and lower **Module** back into instrument.

19. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W7 SW LINES.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A14.17** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 2 min. | |


Internal Voltmeter **(VM)** is used to check power supply levels at inputs to **A14 Module.**

**<u>Run Test</u>**

1. Switch instrument to **Standby:**
   - Disconnect **W7** from **A14** at **A14A2 J2**.
   - Plug end of **W7** **<u>into</u>** **16** pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug W7P2.

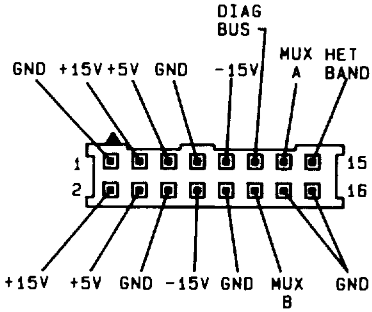
2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A14 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

## A14 MODULE DIAGNOSTICS

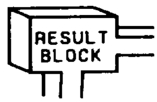
4. Measure voltage levels:
   - Connect VM probe to test connector pin for each power supply line (see **Figure 3L-5. Cable Plug W7P2 Signal Locator**).
   - [5] [HZ] (To make each voltage measurement).

**Figure 3L-5. Cable Plug W7P2 Signal Locator**

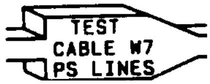



5. Record test results.

6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST Vdc.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A14.18** |
| **Run time:** | 2 min. |  |
| **Set-up time:** | 3 min. | |

Internal Voltmeter **(VM)** is used to check power supply levels at **A5J2.**

**<u>Run Test</u>**

1. Switch instrument to Standby.

2. Extend **A14 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W7** from **A5 Assembly** at **A5J2.** (See table on foldout in **MECHANICAL PROCEDURES** to locate **A14 Module** extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove **A4** (para 5-6) to disconnect cable **W7**.

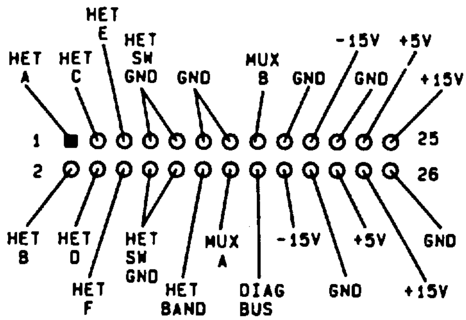
3. Connect VM probe:
   - Connect rid alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A14 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

4. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

## A14 MODULE DIAGNOSTICS

5. Measure all voltage levels at **A5J7**:
   - Access signals from solder-side of **A5J7.** (See **Figure 3L-6. A5J7 Signal Locator.)**
   - [5] [HZ] (To make each voltage measurement.)

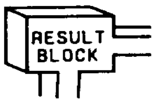
**Figure 3L-6. ASJ7 Signal Locator**
**(Solder-Side View)**




6. Record test results.

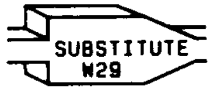
7. Reconnect **W7** and lower **Module** back into instrument.

8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST CABLE W7 PS LINES.**



## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitute | **A14.19** |
| **Run time:** | 5 min. | |
| **Set-up time:** | 1 min. | |



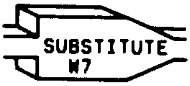

1 Testing has shown cable **W29** or **W34** to be suspect, temporarily replace **W29** with a test cable from the On-Site Service Kit. Cable **W34** should be replaced by a semi-rigid cable. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

2. Deleted.

3. Return to foldout.

## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitute | **A14.20** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 3 min. | |




Testing has shown cable **W7** to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

**CAUTION**

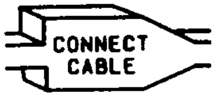
When connecting ribbon cable to A14 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W7**

1. Switch instrument to Standby to connect cable **W7** to **A5** Assembly and **A14** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on connecting cable **W7** to **A5J7.)**

2. Return to foldout.

## A14 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A14.21** |
| **Run time:** | 0 min. |  |
| **Set-up time:** | 3 min. | |

**CAUTION**

When connecting ribbon cable to A14 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W7**

1. Switch instrument to Standby to reconnect cable **W7** to **A5** Assembly or **A14** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on reconnecting cable **W7** to **A5J7.)**

2. Return to foldout.

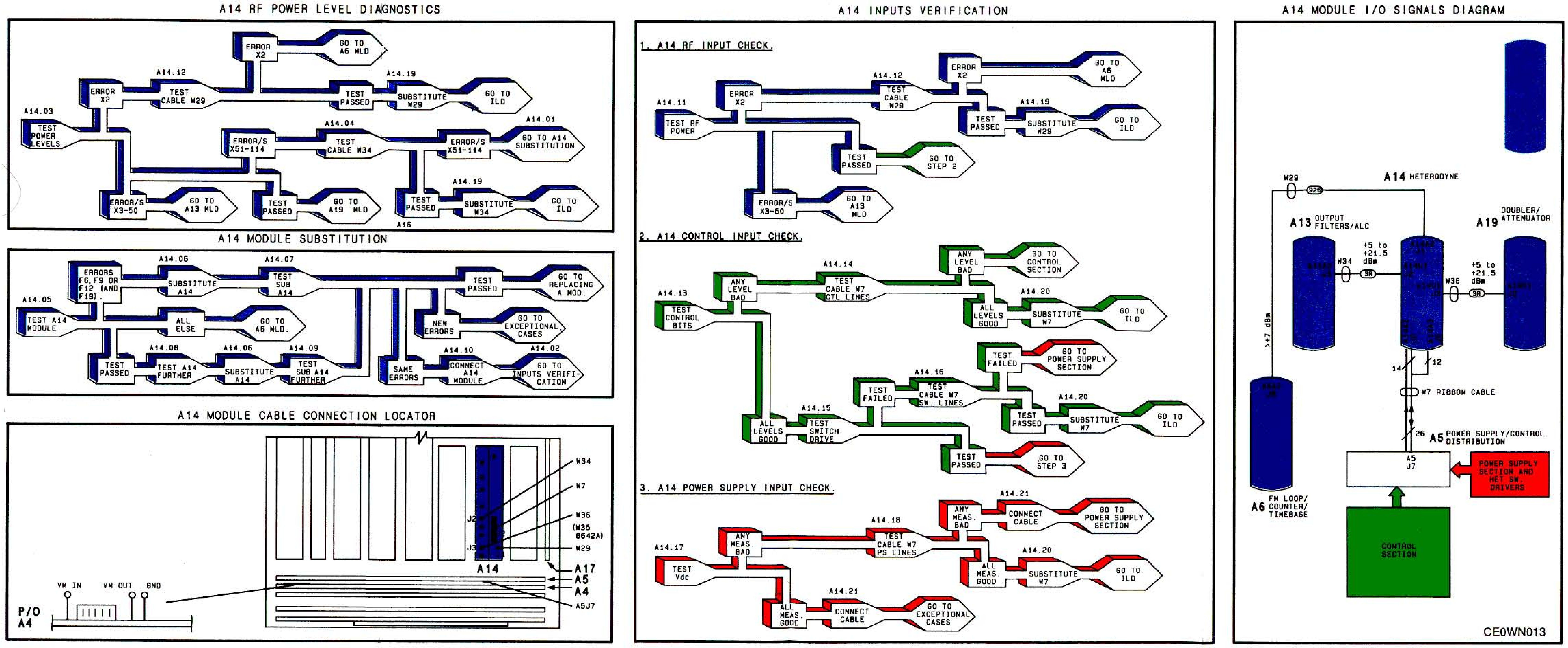



Figure 3L-100. A14 Heterodyne Module Diagnostics.

## A16 ATTENUATOR MODULE

### 3M-1. DELETED.

## A19 DOUBLER/ATTENUATOR MODULE

### 3N-1. INTRODUCTION

The **MODULE LEVEL DIAGNOSTICS (MLD)** contained in this section are used to further interrogate the **A19 Module (HP 8642B only).** The objective is to isolate the failure indicated for this module to the module itself or to a part on which it depends for operation.

**NOTE**

At this level of testing, recommendations for further action are made on the assumption that the **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** showed no failures for modules **A01-A17.** (For information on using the on-site diagnostics, refer to the **INTRODUCTION** section of this manual.)

**CAUTION**

When tightening the coax cable connectors, do not exceed a torque of 1.0 Nm or. 74 ft-lbs (slightly tighter than fingertight).

When coax cables are disconnected from instrument, do not allow loose ends to come in contact with any exposed circuitry susceptible to short circuiting.

**Test Instructions**

1. The instrument's **Top Cover** must be removed to run many of these tests. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate instructions.)

2. **The last page in this group of tests is a foldout and should be pulled out now.**

3. Turn to the next page to begin the **A19 MLD.**

## A19 MODULE SUBSTITUTION

### 3N-2. INTRODUCTION

**NOTE**

If a known good module is not available, proceed to the next page, **A19 INPUTS VERIFICATION.**

The first step in isolating an **A19** failure is to substitute in a known good module from the On-site Service Kit.

**A19 Substitution Instructions**

1. Find **A19 MODULE SUBSTITUTION** on the foldout.

2. Use the Task Sequence Diagram, shown under **A19 MODULE SUBSTITUTION**, to direct you through the substitution process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

3. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

4. Begin now by performing the first task shown on the diagram.

## A 19 INPUTS VERIFICATION

3N-3. INTRODUCTION

**A19.01**


If a known good **A19 Module** is not available or, if you were not able to isolate the failure using the **A19 MODULE SUBSTITUTION** procedure the Task Sequence Diagrams (shown under **A19 INPUTS VERIFICATION)** should be used to check each signal path into the **A19 Module.**

**A19 Inputs Verification Instructions**

1. Find **A19 INPUTS VERIFICATION** on the foldout.

2. The Task Sequence Diagrams, shown under **A19 INPUTS VERIFICATION**, are separated into three checks: **RF, Control** and **Power Supply** signals.

3. Use the Task Sequence Diagrams to direct you through the verification process. Each Task Arrow shown in a diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown under
   **1. POWER SUPPLY INPUT CHECK.**

**NOTE**

The **A19 MODULE I/O SIGNALS DIAGRAM** shows all parts which the **A19 Module** depends on for operation.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 1; Loop Lock/Unlock | A19.02 |
| **Run time:** | 40 sec. | |
| **Set-up time:** | 0 | |


**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

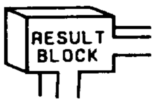
2. [SHIFT] [SPCL] [3] [3] [5] [8] [HZ].

3. When **"DIAG DONE HIT MSSG V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A19.**

**NOTE**

If any error codes are displayed for modules **A01-A17** you need to isolate those failure(s) before performing the **A19 MODULE SUBSTITUTION.** (Refer to **INSTRUMENT LEVEL DIAGNOSTICS** to determine correct order for troubleshooting modules.)

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST A19 MODULE.**



## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A19.03** |
| **Run time:** | 0 | |
| **Set-up time:** | 7 min. | |


**Connect Substitute Module**

1. Switch instrument to Standby.

2. Remove **A19 Module** and install substitute module (refer to table on foldout in **MECHANICAL PROCEDURES** to locate removal and replacement information).

3. Turn instrument on.

4. Return to foldout.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Substitute Module Test | **A19.04** |
| **Run time:** | 40 sec. | |
| **Set-up time:** | 0 | |


Test operation of **substitute A19 Module** by repeating test performed on A19 Module before substitution.

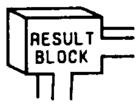
**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ  -140.0DM"** appears, to override 20 second reset test.)

2. [SHIFT]  (SPCL) [3] [3] [5] [8] [HZ]

3. When **"DIAG DONE  HIT MSSG .V1"** appears:
   - Use [MSSG] to scroll through messages.
   - Record error code(s) displayed for **A19**.  If **"TEST 1 OF A19** (**PASSED** or **FAILED**)" is not displayed, rerun test.

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **TEST SUB A19**.



| | | |
|---|---|---|
| **Type:** | Additional A19 Tests | **A19.05** |
| **Run time:** | Conditional |  |
| **Set-up time:** | Conditional | |



**CAUTION**

Do not permit end of internal Power Meter cable to short circuit instrument by coming in contact with any exposed circuitry.

The **A19** failure conditions for arriving at this task are described below. Follow the procedure for the condition which fits your module.

**Condition 1:** **Instrument Level Self Test** indicated **A19** failure.

**Condition 2:** Instrument has a power level failure and **A14 Module RF Power Level Test** indicated power level good out of **A14**.

**Condition 3:** Instrument must be set to a specific operating condition to detect **A19** failure.

**Condition 1**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM**" appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [5] [8] [HZ]
3. When **"WAITING FOR SET-UP 1 .V24"** appears:
   - Connect BNC Tee connector from On-Site Service Kit, to "**FM/ΦM INPUT**" (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to "**MOD OUTPUT**".
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue test.
4. When "**DIAG DONE HIT MSSGS .V1**" appears:
   - Use [MSSG] to scroll through messages.'
   - Record **A19** error codes.

**NOTE**

If any error codes are displayed for modules **A01- A17**, you need to isolate those failure(s) before Performing the **A19 MODULE SUBSTITUTION**. Refer to **INSTRUMENT LEVEL DIAGNOSTICS** to determine correct order for troubleshooting modules.)

5. Return to foldout.

**Condition 2**

**NOTE**

If an external power measuring instrument is available, use it to make power measurements.

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. Connect Power Meter **(PM):**
   - Connect Yellow **PM** cable and adapters to instrument's **RF** Output port **CP1**.
3. To use Internal Power Meter:
   - [SHIFT] [SPCL] [3] [2] [4] [HZ]
   - [4] [HZ] to repeat measurement.
   - Key sequence must be repeated for each amplitude or frequency setting change.

**NOTE**

Internal Power Meter should read within **±3 dB** of amplitude setting. The internal power meter cannot measure power levels less than **-10 dBm**.

4. Measure power level:
   - Set instrument's frequency to **2 GHz**.
   - Measure power at amplitude settings of **+10, +5, 0** and **-5 dBm.**
   - Repeat measurement for same amplitude settings at **990** and **4 MHz**.
   - Supplement these measurements with additional readings at other instrument settings if desired.
5. Record test results.
6. Return to foldout.

**Condition 3**

1. Set instrument to operating condition which causes **A19** failure.
2. Record instrument set-up and error message(s).
3. Return to foldout.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Additional Substitute A 19 Tests | **A19.06** |
| **Run time:** | Conditional |  |
| **Set-up time**: | Conditional | |

Test operation of **substitute A19 Module** by repeating test(s) performed on Al 19 Module before substitution.

**Condition 1:** **Instrument Level Self Test** indicated **A19** failure.

**Condition 2:** Instrument has a power level failure and **A14 Module RF Power Level Test** indicated power level good out of **A14**.

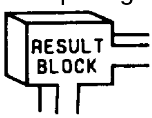
**Condition 3:** Instrument must be set to a specific operating condition to detect **A19** failure.

**<u>Condition 1</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. [SHIFT] [SPCL] [3] [3] [0] [HZ].
3. When **"WAITING FOR SET-UP 1 .VZ4"** appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/ f M INPUT"** (see **INSTRUMENT LEVEL DIAGNOSTICS** foldout for set-up diagram).
   - Connect a coax cable from Tee connector to **"MOD OUTPUT".**
   - Connect a coax cable from Tee to "**AM INPUT**".
   - [HZ] to continue test.
4. When **"DIAG DONE HIT MSSGS .V1"** appears:
   - Use ( MSSG) to scroll through messages.
   - Record **A19** error codes.

**NOTE**

If any error codes are displayed for modules A01-A17, you need to isolate those failure(s) now.

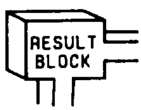
5. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each  for **TEST SUB A19 FURTHER.**

**<u>Condition 2</u>**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM**" appears, to override 20 second reset test.)
2. Connect Power Meter:
   - Connect Yellow **PM** cable and adapters to instrument's **RF Output** port **CP1**.
3. To use Internal Power Meter:
   - [SHIFT] [SPCL] [3] [2] [4] [HZ] '
   - [4] [HZ] to repeat measurement.
     Key sequence must be repeated for each amplitude or frequency setting change.

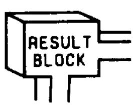
**NOTE**

Internal Power Meter should read within **±3 dB** of amplitude setting. The internal power meter cannot measure power levels less than **-10 dBm**.

4. Measure power level:
   - Set instrument's frequency to **2 GH**z.
   - Measure power at amplitude settings of **+10**, **+5**, **0** and **-5 dBm**.
   - Repeat measurements for same amplitude settings at **990** and **4 MHz**.
   - Supplement these measurements with additional readings at other instrument settings if desired.
5. Record test results.
6. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST SUB A19 FURTHER**.

**<u>Condition 3</u>**

1. Set instrument to operating condition which causes **A19 failure.**
2. Record instrument set-up and error message(s).
3. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

     for **TEST SUB A19** FURTHER.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Module Substitution | **A19.07** |
| **Run time:** | 0 | |
| **Set-up time:** | 7 min. | |


**Connect Module**

1. Switch instrument to **Standby.**

2. Remove substitute **A19 Module** and replace instrument's **A19 Module**.

3. Return **substitute** A 19 Module to On-Site Service Kit.

4. Return to foldout.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A19.08** |
| **Run time:** | 2 min. | |
| **Set-up time**: | 2 min. | |


Internal Voltmeter (**VM**) is used to check power supply levels at inputs to **A19 Module**.

**Run Test**

1. Switch instrument to Standby:
   - Disconnect **W11** from **A19** at **A19A1 J2.**
   - Plug end of **W11** into **34** pin test connector, from On-Site Service Kit.

**NOTE**
Find arrowhead on test connector and align with arrowhead on cable plug **W11P2.**

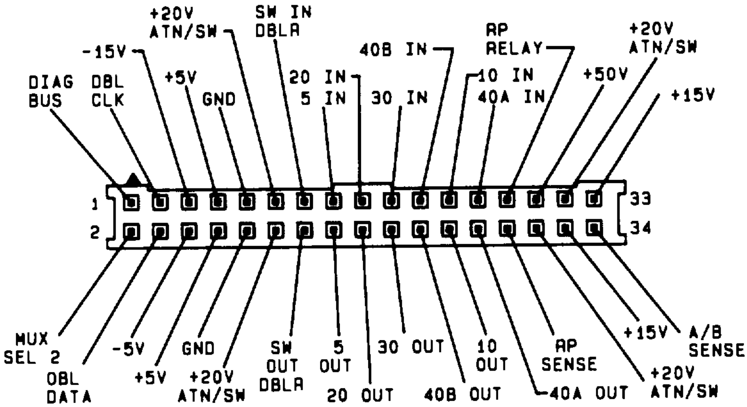
2. Connect **VM** probe:
   - Connect red alligator clip and retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A19 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)

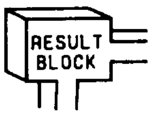
3. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

## A19 MODULE DIAGNOSTICS

4. Measure voltage levels:
   - Connect VM probe to test connector pin for each power supply line including **+20V ATN/SW** lines. (See **Figure 3N-1. Cable Plug W11P2 Signal Locator).**
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3N-1. Cable Plug W11P2 Signal Locator**

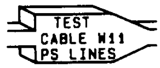



5. Record test results.
6. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

 for **TEST Vdc**.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | 4, Voltage Measurements | **A19.09** |
| **Run time:** | 2 min. | |
| **Set-up time:** | 3 min. | |




Internal Voltmeter **(VM)** is used to check power supply levels at **A5J2.**

**<u>Run Test</u>**

1. Switch instrument to Standby.
2. Extend **A19 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W11** from AS Assembly at **A5J8**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate **A19 Module** extension and **A5** cable disconnection information.)

**NOTE**

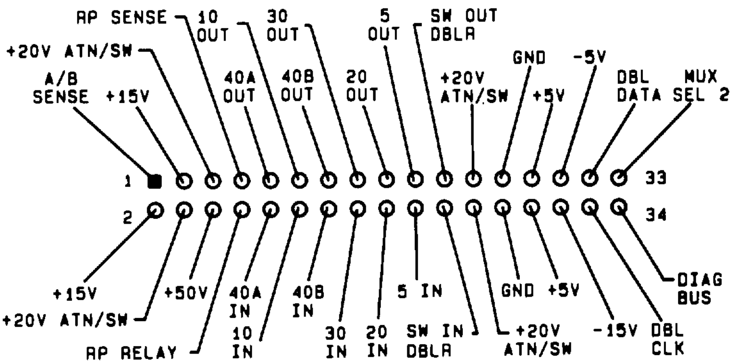
It may be necessary to remove **A4** (para 5-6) to disconnect cable **W11.**

3. Connect **VM** probe:
   - Connect red alligator clip and pointed tip probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A19 MODULE CABLE CONNECTION LOCATOR** on foldout for VM IN location.)
4. Turn instrument on and enter:
   [SHIFT] [SPCL] [3] [2] [5] [HZ]
   (To enable Internal Voltmeter.)

## A19 MODULE DIAGNOSTICS

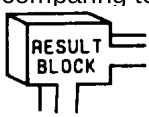
5. Measure voltage levels at **A5J8:**
   - Access signals from solder-side of **A5J8**. (See **Figure 3N-2. A5J8 Signal Locator**.)
   - [5] [HZ] (To make each voltage measurement.)

**Figure 3N-2. A5J8 Signal Locator**
**(Solder-Side View)**




6. Record test results.

7. Reconnect **W11** and lower **Module** back into instrument.

8. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

 for **TEST CABLE W11 PS LINES**.

## A19 MODULE DIAGNOSTICS

**Type:** 3; Driver Transmission **A19.10**
**Run time:** 1 min.
**Set-up time:** 0


Attenuator drive lines are checked by separately selecting relays and listening for attenuator pads to click in and out.

**NOTE**
Instrument's Top Cover should be removed to perform this test.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. Set instrument to zero attenuation:
   - [AMPTD] [1] [0] [DBM]
3. Check relay drivers:
   - Select **Amplitude Setting** for **Attenuator Relay** to be tested (from **Table 3N-1. A19 Attenuator Relay Selection)** and listen for pad to click in.
   - Select [1] [0] [DBM] and listen for attenuator pad to click out.
   - Repeat process for each relay listed in **Table 3N-1.**

**Table 3N-1. Attenuator Relay Selection**

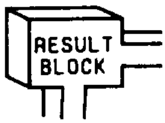
| Test Order | Amplitude Setting | Attenuator Relay |
|---|---|---|
| 1 | [0] [DBM] | 5 dB pad |
| 2 | [-] [5] [DBM] | 10 dB pad |
| 3 | [-] [1] [5] [DBM] | 20 dB pad |
| 4 | [-] [2] [5] [DBM] | 30 dB pad |

## A19 MODULE DIAGNOSTICS

**NOTE**

This procedure does not check the two **40 dB** relay drivers. They can be checked using an external power measuring device connected at the output of A19. Check power out at settings of -60.1 dBm to -100 dBm (40 dB pad A) and -100.1 to -140 dBm (40 dB pad B).

4. Record test results.

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

for **TEST ATN DRIVE LINES.**

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| Type: | 3; Bit Transmission | **A19.11** |
| Run time: | 3 min. |  |
| Set-up time: | 2 min. | |

Internal Voltmeter (**VM**) is used to measure TTL level changes transmitted to **A19 Module** on Clock and Data control Lines.

**<u>Run Test</u>**

1. Switch instrument to Standby:
   - Disconnect cable **W11** from module at **A19A1 J2**.
   - Plug end of **W11** <u>into</u> **34** pin test connector, from On-Site Service Kit.

**NOTE**

Find arrowhead on test connector and align with arrowhead on cable plug **W11P2**.

**<u>CAUTION</u>**

To prevent damage to the Power Supply and Control sections, do not permit the exposed pins on the test connector to short circuit.

2. Connect **VM** probe:
   - Connect red alligator clip and -retractable hook probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1)**. (See **A19 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)
3. Turn instrument on.
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)

**<u>Clock Line</u>**

**Check High State**

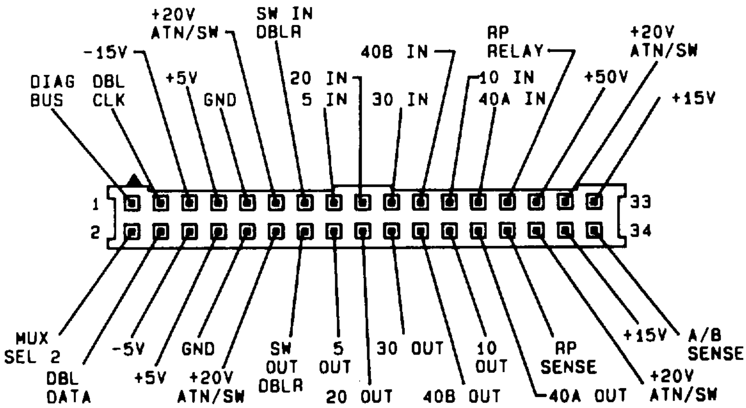
4. [SHIFT] [SPCL] [3] [6] [0] [2]
   To specify high state.)

**NOTE**

A "0" will appear in display indicating that the data bit will be set low. However, the bit is inverted in the Control Section before it is sent to A19.

5. [2] [4] [HZ]
   (To select bit.)
6. Connect **VM** probe to test connector line **DBL CLK** (pin 3).
   (**See figure 3N-3. Cable Plug W11P2 Signal Locator.)**

**Figure 3N-3. Cable Plug W11P2 Signal Locator**




7. [2] [5] [HZ]
   (To enable voltmeter.)
8. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
   ([5] [HZ] to repeat measurement.)

**Check Low State**

9. [SHIFT] [SPCL] [3] [6] [0] [1]
   (To specify low state.

**NOTE**

A "**1**" will appear in display indicating that the data bit will be set high. However, the bit is inverted in the Control Section before it is sent to **A19**.

10. [2] [4] [HZ]
    (To enable voltmeter.)
11. [2] [5] [HZ]
    (To enable voltmeter.)
12. Voltage should read approximately **-0.5** to **+1.5 Vdc,**
    ([5] [HZ] to repeat measurement.)

**Data Line**

**Check High State**

13. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To specify high state.)
14. [2] [5] [HZ]
    (To select bit.)
15. Connect VM probe to test connector line DBL DATA (pin 4). **(See figure 3N-3. Cable Plug W11P2 Signal Locator.)**
16. [2] [5] [HZ]
    (To enable voltmeter.)
17. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

**Check Low State**

18. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state)
19. [2] [5] [HZ]
    (To select bit.)
20. [2] [5] [HZ]
    (To enable voltmeter.)
21. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

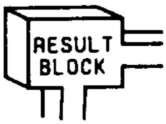
**Multiplexer Select Line**

**Check High State**

22. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify high state.)
23. [8] [HZ]
    (To select bit.)

## A19 MODULE DIAGNOSTICS

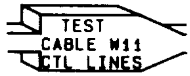
24. Connect **VM** probe to test connector line MUX SEL 2 (pin **2**). **(See figure 3N-3. Cable Plug W11P2 Signal Locator.)**
25 [2] [5] [HZ]
(To enable voltmeter.)
26. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
[5] [HZ] to repeat measurement.)

**Check Low State**
27. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify low state.)
28. [8] [HZ]
(To select bit.)
29 [2] [5] [HZ]
(To enable voltmeter.)
30. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
([5] [HZ] to repeat measurement.)
31. Record test results.
32. Return to foldout:
- Determine next task by comparing test results to conditions shown in each 

for **TEST CONTROL BITS.**

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| Type: | 3; Bit Transmission | **A19.12** |
| Run time: | 3 min. | |
| Set-up time: | 3 min. | |




Internal Voltmeter **(VM)** is used to measure TTL level changes transmitted to **A19 Module** on SAWR oscillator select lines **A** and **B**.

**Run Test**

1. Switch instrument to **Standby**.
2. Extend **A19 Module** on extender posts, from On-Site Service Kit, to disconnect cable **W11** from **A5 Assembly** at **A5J8**. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate **A19 Module** extension and **A5** cable disconnection information.)

**NOTE**

It may be necessary to remove A4 (para 5-6) to disconnect cable **W11.**

3. Connect **VM** probe:
   - Connect red alligator clip and **pointed tip** probe to red test lead provided in On-Site Service Kit.
   - Connect alligator clip to **VM IN (A4TP1).** (See **A19 MODULE CABLE CONNECTION LOCATOR** on fold-out for **VM IN** location.)
4. Turn instrument on.

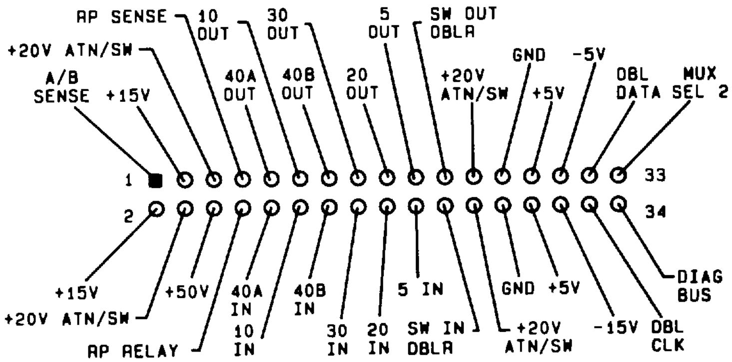
**Clock Line**

**Check High State**

5. [SHIFT] [SPCL] [3] [6] [0] [2]
   (To specify high state.)
6. [2] [4] [HZ]

7. Connect **VM** probe to solder-side of **A5J8** line **DBL CLK** (pin 32). **(See Figure 3N-4. A5J8 Signal Locator.)**

**Figure 3N-4. ASJ8 Signal Locator (Solder-Side View)**




8. [2] [5] [HZ]
(To enable voltmeter.)
9. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Check Low State**

10. [SHIFT] [SPCL] [3] [6] [0] [1]
(To specify low state)
11. [2] [4] [HZ]
(To select bit.)
12. [2] [5] [HZ]
(To enable voltmeter.)
13. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
([5] [HZ] to repeat measurement.)

**Data Line**

**Check High State**

14. [SHIFT] [SPCL] [3] [6] [0] [2]
(To specify high state.)
15. [2] [5] [HZ]
(To select bit.)

16. Connect **VM** probe to solder-side of **A5J8** line **DBL DATA** (pin **31**). (**See Figure 3N-4. A5J8 Signal Locator**.)
17. [2] [5] [HZ]
    (To enable voltmeter.)
18. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

**Check Low State**

19. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify low state.)
20. [2] [5] [HZ]
    (To select bit
21. [2] [5] [HZ]
    (To enable voltmeter.)
22. Voltage should read approximately **-0.5** to **+1.5 Vdc.**
    ([5] [HZ] to repeat measurement.)

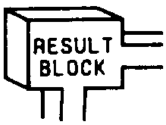
<u>**Multiplexer Select Line**</u>

**Check High State**

23. [SHIFT] [SPCL] [3] [6] [0] [1]
    (To specify high state.)
24. [8] [HZ]
    (To select bit.)

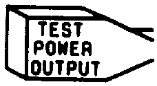
25. Connect **VM** probe to solder-side of **A5J8** line **MUX SEL 2** (pin **33**). (**See Figure 3N-4. A5J8 Signal Locator**.)
26. [2] [5] [HZ]
    (To enable voltmeter.)
27. Voltage should read approximately **+2.5** to **+5.5 Vdc**.
    ([5] [HZ] to repeat measurement.)

**Check Low State**

28. [SHIFT] [SPCL] [3] [6] [0] [2]
    (To specify low state.)
29. [8] [HZ]
    (To select bit.)
30. [2] [5] [HZ]
    (To enable voltmeter.)
31. Voltage should read approximately **-0.5** to **+1.5 Vdc**.
    ([5] [HZ] to repeat measurement.)
32. Record test results.
33. Reconnect **W11** and lower **Module** back into instrument.
34. Return to foldout:
    - Determine next task by comparing test results to conditions shown in each 

for **TEST CABLE W11 CTL LINES**.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | RF Power | **A19.13** |
| **Run Time:** | 4 min. |   |
| **Set-up Time:** | 3 min. | |

Internal Power Meter (PM) is used to test output power levels.

**NOTE**

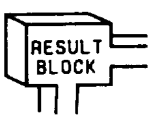
If an external power measuring instrument is available, use it to make power measurements.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.)
2. Connect Power Meter:
   - Connect Yellow **PM** cable and adapters to instrument's **RF Output** port **CP1**.
3. To use Internal Power Meter:
   - [SHIFT] [SPCL] [3] [2] [4] [HZ]
   - [4] [HZ] to repeat measurement.
   - Key sequence must be repeated for each amplitude or frequency setting change.

**NOTE**

Internal Power Meter should read within **+3 dB** of amplitude setting. The internal power meter cannot measure power levels less than **-10 dBm**.

4. Measure power level:
   - Set instrument's frequency to **2 GHz.**
   - Measure power at amplitude settings of **+10, +5, 0** and **-5 dBm**.
   - Repeat measurements for same amplitude settings at **990** and **4 MHz**.
   - Supplement these measurements with additional readings at other instrument settings if desired.
5. Record test results.
6. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each   for **TEST POWER OUTPUT.**

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| Type: | RF Power | A19.14 |
| Run Time: | 4 min. |  |
| Set-up Time: | 3 min. | |

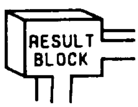
Internal Power Meter (PM) is used to test output power levels.

**<u>Run Test</u>**

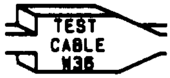
1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ   -140.0DM"** appears, to override 20 second reset test.)
2. Connect Power Meter:
   - Disconnect cable **W38** from **A19 Module** at **A19A2 J2.**
   - Connect power meter to module at **A19A2 J2.**
3. To use Internal Power Meter:
   - [SHIFT] [SPCL] [3] [2] [4] [HZ]
   - [4] [HZ] to repeat measurement.
   - Key sequence must be repeated for each amplitude or frequency setting change.

**NOTE**

Internal Power Meter should read within **+3 dB** of amplitude setting. The internal power meter cannot measure power levels less than **-10 dBm**.

4. Measure power level:
   - Set instrument's frequency to **2 GHz**.
   - Measure power at amplitude settings of **+10, +5, 0** and **-5 dBm.**
   - Repeat measurements for same amplitude settings at **990** and **4 MHz**.
   - Supplement these measurements with additional readings at other instrument settings if desired.
5. Record test results.
6. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each  for **TEST A19 OUTPUT.**

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| Type: | RF Power | **A19.15** |
| Run Time: | 4 min. |   |
| Set-up Time: | 4 min. | |

Internal Power Meter (PM) is used to test output power levels.

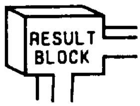
**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ   -140.0DM"** appears, to override 20 second reset test.)
2. Connect Power Meter:
   - Disconnect cable **W38** from **A19 Module** at **A19A2 J2.**
   - Connect power meter to module at **A19A2 J2.**
3. To use Internal Power Meter:
   - [SHIFT] [SPCL] [3] [2] [4] [HZ]
   - [4] [HZ] to repeat measurement.

   **NOTE**

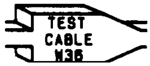
   Internal Power Meter should read within **+3 dB** of amplitude setting. The internal power meter cannot measure power levels less than **-10 dBm**.
4. Measure power level:
   - Set instrument's frequency to **2 GHz**.
   - Measure power at amplitude settings of **+10, +5, 0** and **-5 dBm**.
   - Repeat measurements for same amplitude settings at **990** and **4 MHz**.
5. Substitute cable **W36**:
   - Disconnect cable **W36** from **A14** and **A19** modules at **A14U1 J3** and **A19K1 J2**.
   - Connect flexible coax cable from On-Site Service Kit to modules at **A14U1 J3** and **A19K1 J2.**

## A19 MODULE DIAGNOSTICS

6. Measure power level:
   - Repeat measurements made in step **4**.
7. Record test results.
8. If power level still fails, reconnect semi-rigid cable **W36** to **A14** and **A19** modules.
9. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each 

for **TEST CABLE W36**.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | RF Power | **A19.16** |
| **Run Time:** | 5 min. |  |
| **Set-up Time:** | 5 min. | |

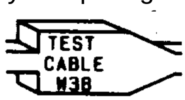
Internal Power Meter (PM) is used to test output power levels.

**Run Test**

1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ   -140.0DM"** appears, to override 20 second reset test.)
2. Connect Power Meter:
   - Connect Yellow **PM** cable and adapters to instrument's **RF Output** port **CP1**.
3. Substitute cable **W38**:
   - Disconnect cable **W38** from **A19 Module** at **A19A2 J2** and from cable **W16** at **W16P2**
   - Connect flexible coax cable from On-Site Service Kit to **A19 Module** and cable **W16**.
4. To use Internal Power Meter:
   - [SHIFT] [SPCL] [3] [2] [4] [HZ]
   - [4] [HZ] to repeat measurement.
   - Key sequence must be repeated for each amplitude or frequency setting change.

**NOTE**

Internal Power Meter should read within **+3 dB** of amplitude setting. The internal power meter cannot measure power levels less than **-10 dBm**.

5. Measure power level:
   - Set instrument's frequency to **2 GHz**.
   - Measure power at amplitude settings of **+10, +5, 0** and **-5 dBm**.
   - Repeat measurements for same amplitude settings at **990** and **4 MHz**.
6. Record test results.
7. If power level still fails, reconnect semi-rigid cable **W38** to **A19 Module** and cable.
8. Return to foldout.
   - Determine next task by comparing test results to conditions shown in each  **TEST CABLE W38.**

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A19.17** |
| **Run Time:** | 5 min. |  |
| **Set-up Time:** | 1 min. | |

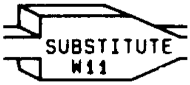
1. Testing has shown cable **W36** or **W38** to be suspect, replace with a semi-rigid. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

2. Deleted.

3. Return to foldout.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Substitution | **A19.18** |
| **Run time:** | 0 min. | |
| **Set-up time:** | 3 min. | |




Testing has shown cable W11 to be suspect, temporarily replace with a spare ribbon cable if available. Rerun **INSTRUMENT LEVEL DIAGNOSTICS (ILD)** to confirm repair.

**CAUTION**

When connecting ribbon cable to A19 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W11**

1. Switch instrument to Standby to connect cable **W11** to **A5** Assembly and **A19** Module. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on connecting cable **W11** to **A5J8**.)

2. Return to foldout.

## A19 MODULE DIAGNOSTICS

| | | |
|---|---|---|
| **Type:** | Cable Connection | **A19.19** |
| **Run time:** | 0 min. |  |
| **Set-up time:** | 3 min. | |

**CAUTION**

When connecting ribbon cable to A19 Module, find arrowhead on the cable plug and align with arrowhead on the board connector.

**Reconnect W11**

1. Switch instrument to Standby to reconnect cable **W11** to **A5** Assembly or **A19 Module**. (Refer to table on foldout in **MECHANICAL PROCEDURES** for information on reconnecting cable **W11** to **A5J8.)**

2. Return to foldout.

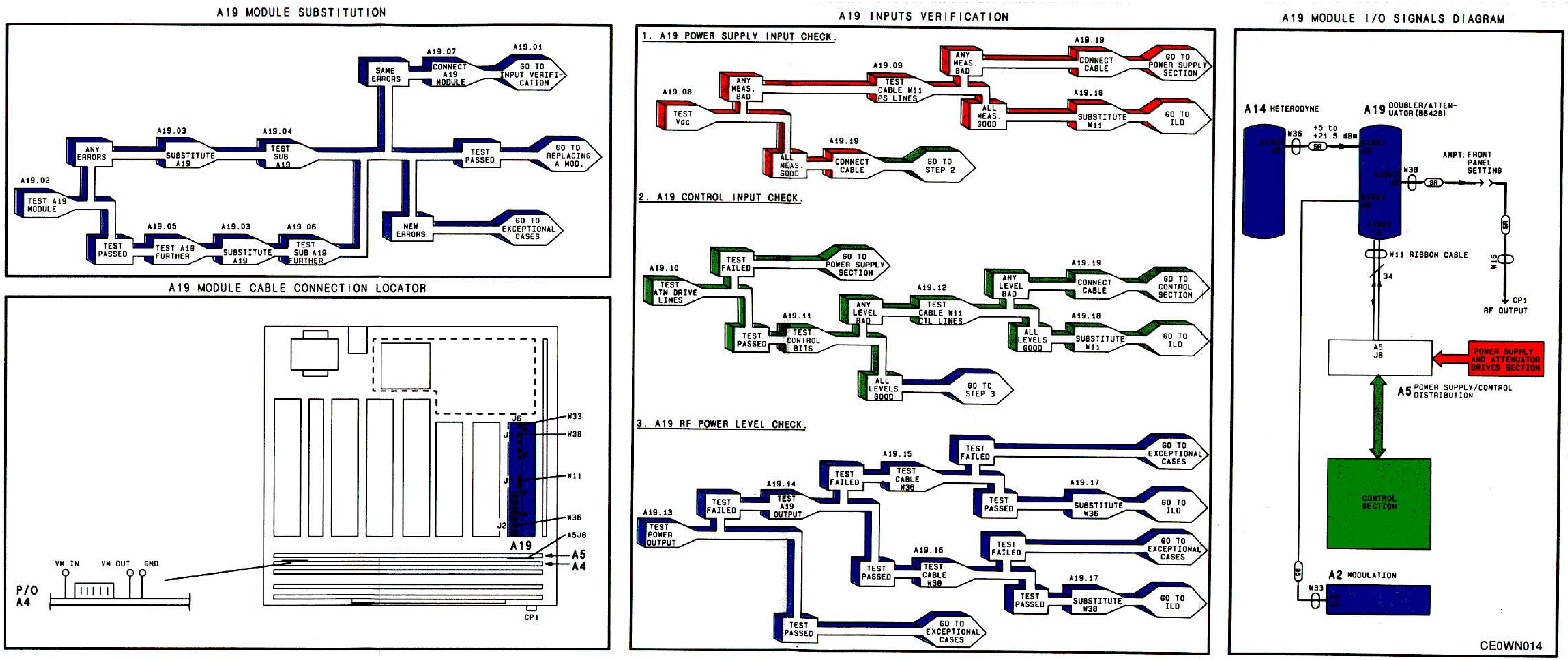



Figure 3N-100. A19 Double/Attenuator Module Diagnostics.

## EXCEPTIONAL CASES

### 3O-1. INTRODUCTION

This section contains suggestions for isolating HP 8642 failures which are beyond the 80% coverage provided by the troubleshooting techniques in the Diagnostics Section of this manual.

**NOTE**

The material in this section places a higher reliance on the training and experience of the user. Certain suggestions and techniques presented in this section may seem vague to those without prior service training or experience on the HP 8642.

### 3O-2. EXCEPTIONAL CASE DESCRIPTIONS

To use this section, begin by identifying the **Exceptional Case Description** which best describes your circumstance. Then reference to the Troubleshooting Suggestions provided for that particular **Exceptional Case**.

**Exceptional Case 1**

You were directed here from the DIAGNOSTICS Section by a gotogon labeled,


(refer to paragraph **3O-4**).

**Exceptional Case 2**

You are here because of an output power level problem which is less than 10 dB out of specification or which occurs only at output amplitude settings of below -10 dBm (refer to paragraph **3O-5**).

**Exceptional Case 3**

Miscellaneous failure conditions not covered directly by the **DIAGNOSTICS** Section procedures (refer to paragraph **3O-6**).

### 3O-3. TROUBLESHOOTING SUGGESTIONS

Reference to the appropriate **Exceptional Case** to find the troubleshooting suggestions which apply to your circumstances.

## 3O-4. EXCEPTIONAL CASE 1

**NOTE**

Before proceeding with any of the troubleshooting suggestions, check all cable connections on the suspect module. Verify that the connections are correct at both ends of each cable that connects to the suspect module. (Refer to the Top View diagram on the inside top cover of the instrument for cable connection information.)

**Condition 1:** Failure not isolated after performing module substitution and verifying all inputs.

**Condition 2:** Failure not isolated after verifying all inputs; however a known good substitute module is not available.

**Condition 3:** The substitute module produced "new" failure data.

**Condition 4:** Miscellaneous failure conditions that are not covered by conditions 1, 2, or 3.

**Condition 1: Troubleshooting**

If you have an On-Site Service Kit, or access to a set of known good modules, the most efficient way to isolate a fault, under the present circumstances, is to systematically substitute the parts on which the suspect module depends for its operation.

**NOTE**

If you do not have access to known good modules, refer to the troubleshooting suggestions provided for Condition 2.

If you were directed here by the A2, A17, or A18 module diagnostics, proceed directly to step 3.

1. Identify modules to be substituted:
   - Turn back to the diagnostics section for the suspect module and pull out the foldout.
   - Find the I/0 Signals Diagram shown on the foldout. This diagram shows all RF modules which send their output signals directly to the suspect module. These are the modules you will be substituting.

2. Substitute RF Modules:
   - Repeat the Module Substitution procedure provided for the suspect module except this time when you are directed to substitute a known good module for the suspect module, substitute instead a known good module for one of the input modules shown on the **I/O Signals Diagram**.
   - Repeat procedure for each input module, or until failure is Isolated. (If known good test cables are available, use them to connect substitute module into circuit.)

3. Substitute Control Modules:
   - If failure has not yet been isolated, go to the Control Section diagnostics and perform the Module Substitution procedures for the **A4** and **A3** modules.

**NOTES**

If you were sent to this section by the A14 or A19 diagnostics, substitute the A17 Module Also.

If you were sent to this section by the A17.06 test for the Al 7 Module, substitute the AJ9 Module Also.

**<u>Condition 2</u>: Troubleshooting**

**NOTES**

Verification of all inputs to a module that the **Instrument Level Diagnostics** has designated as the appropriate failing module to troubleshoot, provides an 80% probability that the failure is within that module. To increase the probability to 95%, perform the following steps.

1. Recheck all **RF** inputs:
   - Using an external power measuring device rather than the built-in Power Meter, recheck each RF input to the suspect module.

**NOTE**

RF Power levels are provided on the I/O Signals Diagram shown on the foldout for the suspect module.

2. Recheck control inputs:
   - Follow the control input check Task Sequence Diagram shown on the foldout for the suspect module; however, use an external voltmeter to make the test measurements.

3. Recheck power supply inputs:
   - Follow the power supply input check, Task Sequence Diagram shown on the foldout for the suspect module; however, use an external voltmeter to make the test measurements.

**Condition 3: Troubleshooting**

**NOTE**

If the test, that was run to check the substitute module, passed, and the "new errors" indicated failures for a module(s) other than the module under test, you have just isolated one of two (or more) failures present in the instrument. Proceed to the **REPLACING A MODULE** Section and perform the replacement procedures for the module under test. (Then return to the Instrument Level Diagnostics section to begin isolating the remaining failures.)

If the test that was run to check the substitute module, failed, perform the following steps.

1. Check cable connections:
   - Verify that all cables are correctly connected to the substitute module.
2. Check "known good" substitute module:
   - If possible, verify operation of substitute module by substituting it into another HP 8642.
   - If available, use a second known good module for the substitution procedure.

**NOTE**

There are no further troubleshooting suggestions for the **A1**, **A3**, **A4**, **A17** or **A18** modules.

3. Check for multiple failures:
   - If the inputs to the suspect module have not yet been checked, return to the **DIAGNOSTICS** Section and per- form the inputs verification procedures for the suspect module.
   - If all inputs to the suspect module have been verified, refer to **EXCEPTIONAL CASE 1, Condition 2: Troubleshooting** for further troubleshooting suggestions.

**Condition 4: Troubleshooting**

Table 30-1 provides troubleshooting information for Exceptional Case 1 failure conditions that are not covered by the troubleshooting suggestions provided for Conditions 1, 2, or 3.

## EXCEPTIONAL CASES

### Table 3O-1. Troubleshooting Suggestions for Condition 4

| Module | Test | Comment |
|---|---|---|
| A1 | CTL.09 | Disconnect W15 and recheck Vdc at W15 plug. |
| | CTL.11 | Failure isolated to signal path (A5 or W15). |
| A2 | A2.10 | Failure isolated to W17. W18 or W19 |
| A3 and A4 | CTL.03<br>CTL.07 | Remove A3 and A4, verify that Vdc levels at A5 connectors are correct before substituting A3 or A4. (Refer to Table 3-5 on foldout for pin numbers.) |
| | CTL.11 | Control line transmission problem; A5 possible cause. |
| A6 | A6.02 | If errors F4, F7 and F10 occur with no ext. ref. connected and A6 substitution indicated same errors, perform A4 substitution procedure in control section diagnostics. |
| | A6.12 | Check power level and frequency accuracy of external reference signal. |
| | A6.13 | If substitute A6 caused same errors, perform A4 substitution procedure provided in control section of this manual. |
| A19 | A19.17 | Failure isolated to signal transmission path; W16 |
| Power Supply | PS.02 | Failure isolated to signal path; A5 possible cause. |
| | PS.06 | Failure isolated to switch path, W15, A5 and W10. |
| | PS.08 | Failure isolated to portion of power supply not considered on-site serviceable. |
| | PS.10 | Failure isolated to signal path; A5 probable cause. |

## 3O-5. EXCEPTIONAL CASE 2

To isolate a power level accuracy problem which is less than 10 dB out of specification or which occurs only at output amplitude settings of below -10 dBm, an external power measuring device is needed.

Pull out the foldout at the back of this section. Use the **RF Modules I/O Signals Diagram** as an aid in isolating the power failure. (To locate the cable connections on the modules, refer to the Top View diagram shown on the inside of the HP 8642's top cover.)

**NOTE**

The output of the A13 Module is a good place to begin making power measurements if you use a half -split approach to fault isolation.

## 3O-6. EXCEPTIONAL CASE 3

Table 30-2 provides troubleshooting suggestions for miscellaneous exceptional cases that are not covered by the information provided for Exceptional Cases 1 or 2.

**Table 3O-2. Exceptional Case 3 Troubleshooting Suggestions**

| Failure Condition | Troubleshooting Suggestions |
|---|---|
| Intermittent Failures | Intermittent failures can greatly reduce the HP 8642's ability to provide reliable test data; module substitution may be the best approach to isolating failures of this nature.* |
| Modulation Related | FM and AM both affected-substitute A2, then A4.<br>FM only affected-substitute A6.<br>AM only affected-substitute A13.<br>AM only in Doubler Band affected-substitute A19. |
| Spurs | Module substitution is highly recommended.*<br>Try tracking the spur back to its source using external test equipment to test the output of each module. (Note that spurs are typically caused by unwanted angle modulation on the carrier signal. The offset frequency of the spur (from the carrier) is equal to the frequency of the unwanted modulation signal. Look for signal sources and mixes in the instrument that equal the spur's offset frequency.) |

**Table 3O-2. Exceptional Case 3**
**Troubleshooting Suggestions (Cont'd)**

| Failure Condition | Troubleshooting Suggestions |
|---|---|
| Phase Noise | Module substitution is highly recommended.' Begin the isolation process by using external test equipment to check the A12 module's input and output signals. (Note that a frequency divider (such as in A12) reduces the carrier's phase noise component proportionally by the factor of the frequency division. e.g., -4 reduces noise level by 12 dB.) |
| Frequency Accuracy | Module substitution is highly recommended.' Check accuracy of output signals from modules; check timebase output from A6. |
| Sweep Output | Follow the substitution procedures for the A4 and A3 modules listed in the Control Section of this manual. |
| Store/Recall | Follow the substitution procedures listed in the Control Section of this manual for A3. |
| Front Panel Display/Keyboard | Follow the substitution procedure listed in the Control Section of this manual for A1. |
| Multiple Failures | Follow the troubleshooting procedures provided in the Diagnostics Section of this manual beginning with Instrument Level Diagnostics. |
| Failures Not Detected By Instrument | Module substitution is highly recommended. Use external test equipment to track failure as far as possible.* Substitute module of highest probable cause. If substitution does not isolate the failure, check each input signal to the suspect module. (For module substitution and input verification information, refer to the diagnostic section provided in this manual for the suspect module.) |
| 'Refer to Table 30-3, on the foldout at the back of this section for information on additional techniques that may be helpful for troubleshooting this failure. | |

## Table 3O-3. Service Special Functions for Exceptional Cases

Service Special Functions can only be invoked when in the service mode of operation. To enter service mode select: SHIFT SPCL 3. Each key sequence must be terminated with the Hz key. (For example, to enter Controller mode and enable Continuous Cycle : **SHIFT SPCL 3 8 8 Hz 3 1 2 5 Hz**.)

| Function Description | Key Sequence | | |
|---|---|---|---|
| **Signal Measurements**<br>Makes measurements using built-in power and volt meters. | 2 | 4 (Power measurement)<br>5 (Voltage measurement) | |
| **Module By-pass**<br>Tests instrument's operation with a specified module by-passed out of signal path. (Setup information for each module by-pass is provided below module labels on foldout at back of this section.) | A7 Enter: 3 2 8<br>A9 Enter: 3 3 9<br>A11 Enter: 3 3 3<br>A12 Enter: 3 4 7<br>A13 Enter: 3 5 3 | | |
| **Controller Mode**<br>Configures HP 8642 to act as a system controller. When connected to a printer, instrument will output the results of a selected diagnostic routine to the printer. (Refer to the HP-IB/REMOTE section for further information.) | 8 8<br><br>8 9 turns controller mode off) | | |
| **Printer Address**<br>Specifies HP-IB address of a printer to be controlled by HP 8642; range 0-30. (01 is default address if not specified.) | **8 1** (Followed by Printer Address) | | |
| **Continuous Cycle**<br>Continuously cycles through a specified diagnostic (switch to Standby to abort). HP 8642 must be connected to a printer and configured to Controller mode before Continuous cycle can be invoked. (See example shown in the box above this table.). | 3 1 | **Instrument Level Sell Test (330):**<br>0 0 | **All Other Diagnostic Routines:** Follow with the last two digits of the diagnostic routine's key sequence. |
| **Stop on Error**<br>Stops diagnostic routine when a specified error occurs. (Instrument is left in operating condition in which error occurred.) This mode can be used in conjunction with Continuous cycle as a means of trapping intermittent failures. | **6 8 0** (Followed by Error Message Code)<br>Error Message Code = Alpha Character Code + numeric value of message.<br>Alpha Character Codes:<br>A = 65000, B = 66000 ...<br>K = 75000 ... R = 82000 ...<br>For example, to stop on error .T07: enter **6 8 0 8 4 0 0 7**.<br>**Hz** key continues test. | | |

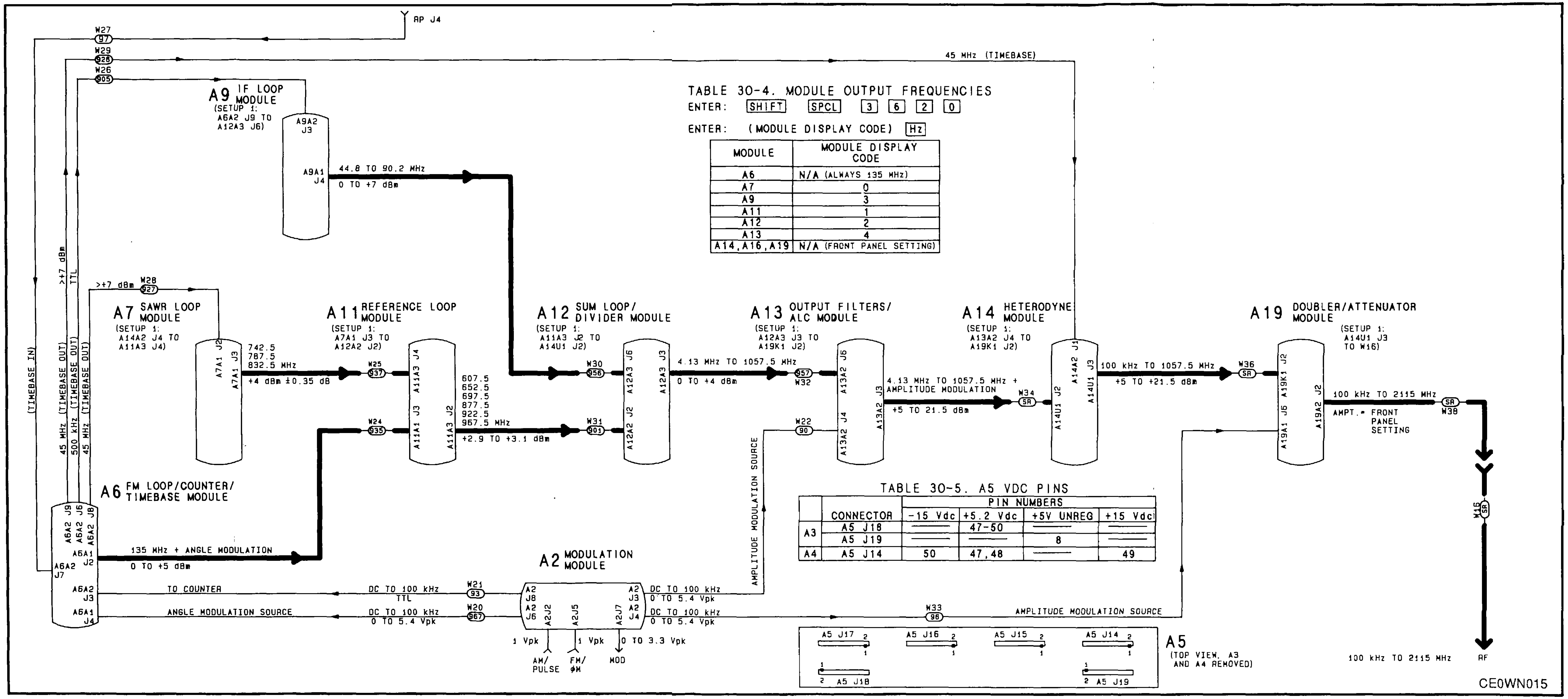



TABLE 3O-4. MODULE OUTPUT FREQUENCIES

ENTER: SHIFT SPCL 3 6 2 0

ENTER: (MODULE DISPLAY CODE) Hz

| MODULE | MODULE DISPLAY CODE |
|---|---|
| A6 | N/A (ALWAYS 135 MHz) |
| A7 | 0 |
| A9 | 3 |
| A11 | 1 |
| A12 | 2 |
| A13 | 4 |
| A14,A16,A19 | N/A (FRONT PANEL SETTING) |

TABLE 3O-5. A5 VDC PINS

| | CONNECTOR | PIN NUMBERS -15 Vdc | +5.2 Vdc | +5V UNREG | +15 Vdc |
|---|---|---|---|---|---|
| A3 | A5 J18 | — | 47-50 | — | — |
| | A5 J19 | — | — | 8 | — |
| A4 | A5 J14 | 50 | 47,48 | — | 49 |

**Figure 3O-100. Exceptional Cases Troubleshooting Diagram**

# SECTION IV. REPLACING A MODULE

## 4-1. INTRODUCTION

This section contains information for performing a module replacement on-site. Module replacement is the last step in the on-site repair process and should only be performed after the replacement module has been tested using the module substitution techniques described in Module Level Diagnostics (refer to the section tabbed for the module you are replacing to find the module substitution procedure). For further information on using the on-site diagnostics, refer to the **INTRODUCTION** section of the manual.

**Replacement Instructions**

1. **The last page in this section is a foldout and should be pulled out now.**

2. Find **MODULE REPLACEMENT** on the foldout.

3. Use the Task Sequence Diagram, shown under **MODULE REPLACEMENT** to direct you through the testing process. Each Task Arrow shown in the diagram indicates a task title and task number. The tasks are numbered according to the order in which they are arranged in this section. Turn to the task indicated and complete the procedure.

4. After completing the procedure, return to the Task Sequence Diagram on the foldout and determine the next task to be performed.

5. Begin now by performing the first task shown on the diagram, **RM.01**.

## REPLACING A MODULE

| | | |
|---|---|---|
| **Type:** | Mechanical Procedure | **RM.01** |
| **Run Time:** | N/A | |
| **Set-up Time:** | Refer to Section V | |


**NOTE**

If you are replacing module **A3, A4, A14 A17, A18, or A19**, and have performed the module substitution test, the module should already be installed in instrument. Check that cable connections and module retaining clips are secure and return to foldout.

1. Replace module:
   - **MECHANICAL PROCEDURES** section provides re- placement procedures for all on-site replaceable modules. Refer to table on foldout in **MECHANICAL PROCEDURES** to locate module replacement information.

2. Reconnect Cables:
   - Connect cable to replacement module (see **INSTRUMENT WIRING DIAGRAM** on foldout for cable connection and routing information).

3. Return to foldout.

## REPLACING A MODULE

| | | |
|---|---|---|
| **Type:** | Cal Data Transfer | **RM.02** |
| **Run Time:** | 2 min. | |
| **Set-up Time:** | 4 min. |  |



**NOTE**

The following modules do not require Calibration Data: **A1**, **A4**, **A7**, **A9**, **A17**, and **A18**. If you are replacing one of these modules, this procedure does not apply; return to foldout now.

**Set-Up Cal Board**

1. Remove **A20 Calibration Module**, provided with replacement module, from On-Site Service Kit.

**NOTE**

To view contents of A20, proceed with paragraph 4-2.

2. Switch [POWER] to **Standby** and connect **Cal Board** to **A3 Module** at **A3J3**. (See **INSTRUMENT WIRING DIAGRAM** on foldout for **A3J3** location.)

3. Switch instrument **ON**.

**NOTE**

It you are replacing module **A3**, **A11**, or **A12** and performed a **Calibration Data Down-Load** as part of the substitution procedure, proceed directly to **Up-Load Cal Data**, following step **7**, of this procedure.

**Down-Load Cal Data**

**NOTE**

This portion of the procedure down-loads the calibration data for the replacement module into the instrument. This data replaces the cal data for the defective module.

**CAUTION**

Sliding switch **A3S2** to its rear position **unprotects** the HP 8642 EEPROMs. To prevent an)y damage to the instrument's memory, carefully perform the steps in this procedure in the order which they are given.

## REPLACING A MODULE

**NOTE**

If you get off track, immediately return **A3S2** to its **protect** position, switch the instrument to **Standby** then back **ON**, and begin again at step **4**.

4. When **"100.000000MZ -140.0DM appears:**
   - Slide **A3S2** back toward rear of instrument. (See **INSTRUMENT WIRING DIAGRAM** on foldout to locate **A3S2.**)

**NOTE**

If your are replacing the **A19 Module**, you need to perform steps **5** and **6** three times; one time for each of the three separate Cal Data Select Key sequences shown for **A19**.

5. [SHIFT] [SPCL] [3] [7] [3]

6. Enter **Cal Data Select Keys,** shown on foldout in **CAL DATA TRANSFER TABLE**, for module being replaced.

7. When **"TRANSFER VERIFIED .U613"** appears:
   - Slide **A3S2** toward front of instrument to **protect** instrument's memory.

### Up-Load Cal Data

This portion of the procedure creates a **new backup A20 Calibration Module** for the instrument by up-loading all of the instrument's current Cal Data onto the replacement **A20 Module**.

**CAUTION**

Moving switch **A20S1** on the **A20 Module** down to its **CHANGE** position unprotects the A20 EEPROMs. To prevent any damage to the A20 EEPROMs, carefully perform the steps in this procedure in the order which they are given.

**NOTE**

If you get off track, immediately return **A20S1** to its **PROTECTED** position, switch the instrument to **Standby** then back **ON**, and begin again at step 8.

8. Move **A20S1** down to its **CHANGE** position.

9. [SHIFT] [SPCL] [3] [7] [4] [HZ]
   (To up-load entire instrument's cal data)

10. When **"10 SECTIONS STORED .U610"** appears:
    - Move **A20S1** up to its **PROTECTED** position.
    - [HZ] to end routine.

11. Switch [POWER] to Standby.

12. Remove old back-up **CALIBRATION MODULE A20** from Rear Panel of instrument. (Refer to table on foldout in **MECHANICAL PROCEDURES** to locate removal instructions.)

13. Put **A20 Module** from rear of instrument in On-Site Service Kit with defective module. (Place red defective marker in slot with module.)

14. Remove new back-up **A20 Module** from **A3J3** and store in back of instrument. (Refer to **MECHANICAL PROCEDURES** for **A20** replacement instructions.)

15. Return to foldout.

## REPLACING A MODULE

| | | |
|---|---|---|
| **Type:** | Instrument Level<br>Self Test | **RM.03** |
| **Run Time:** | 6 min 30 sec |  |
| **Set-up Time:** | 1 min | |



Over-all operation of module and instrument is tested by running the **Instrument Level Self Test (ILST).**

**NOTE**

If the **ILST** did not detect the failure when run as part of **Instrument Level Diagnostics**, repeat the test(s) which did indicate a failing condition.

**<u>Run ILST</u>**

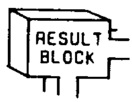
1. [INSTR PRESET] [SHIFT]
   (Hold shift key until **"100.000000MZ -140.0DM"** appears, to override 20 second reset test.

2. [SHIFT] [SPCL] [3] [3] [0] [HZ].

3. When **"WAITING FOR SET-UP 1 .VZ4"** appears:
   - Connect BNC Tee connector, from On-Site Service Kit, to **"FM/FM INPUT".** (See foldout in **INSTRUMENT LEVEL DIAGNOSTICS** section for set-up diagram.)
   - Connect a coax cable from Tee connector to **"MOD OUTPUT"**.
   - Connect a coax cable from Tee to **"AM INPUT".**
   - [HZ] to continue.

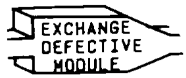
4. When **"DIAG DONE HIT MSSGS .VI"** appears:
   - Use (MSSG) to scroll through messages.
   - Record any module numbers indicated.

5. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **CONFIRM REPAIR.**



## REPLACING A MODULE

| | | |
|---|---|---|
| **Type:** | Module Exchange | **RM.04** |
| **Run Time:** | N/A | |
| **Set-up Time:** | N/A | |




The on-site service process is not finished until all defective parts contained in the On-Site Service Kit have been replaced or repaired.

1. Reassemble any portions of instrument still apart. (Be sure all cable connections are secure.)

2. Flag defective module(s):
   - Red "defective" cards have been placed inside On-Site Service Kit. Place one in slot with defective module so that is is visible when kit is open.

3. Make immediate arrangements for defective part(s) to be repaired and/or replaced in On-Site Service Kit.

4. Return to foldout.

## REPLACING A MODULE

| | | |
|---|---|---|
| **Type:** | Data Analysis | **RM.05** |
| **Run Time:** | N/A |  |
| **Set-up Time:** | N/A | |

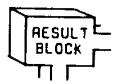
**NOTE**

The **Module Replacement** process is based on the assumption that you were sent to this section after performing a module substitution that passed using the replacement module. If this is not the case, proceed to **RM.07**.

1. Analyze failure data:
   - If the **ILST** was run to confirm the repair, did the test indicate failures for the module being replaced or were failures indicated only for a module(s) other than the one being replaced?
   - If other testing was used to confirm the repair, does the malfunction still appear to be caused by the same module? (If test results are identical to those indicated for the suspect module prior to replacement, the problem is probably in a different module.)

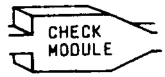
**NOTE**

It is possible that you have repaired one of two (or more) failures in the instrument.

2. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each 

for **ANALYZE FAILURE DATA.**

## REPLACING A MODULE

| | | |
|---|---|---|
| **Type:** | Mechanical Inspection | **RM.06** |
| **Run Time:** | 3 min. 30 sec. |  |
| **Set-up Time:** | Conditional | |

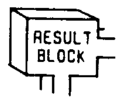


1. Check each cable connection:
   - Make sure each cable connected to module is connected securely **at the correct port.** (See **HP 8642 Table of Cable Connections** on inside of Top Cover to quickly reference cable connections.)
   - Check cable connections for any other cables disconnected during testing.
   - Check for bent pins on ribbon cable connectors.

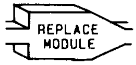
2. Check Cal Data transfer:
   - If module required transfer of calibration data, refer to **CAL DATA TRANSFER TABLE** and verify that the correct **Cal Data Select Keys** were used to down-load the data.

3. Re-run confirmation test:
   - Try re-running same confirmation test(s).

4. Return to foldout:
   - Determine next task by comparing test results to conditions shown in each for **CHECK MODULE.**



## REPLACING A MODULE

| | | |
|---|---|---|
| **Type:** | Module Replacement | **RM.07** |
| **Run Time:** | Conditional |   |
| **Set-up Time:** | Conditional | |

This procedure replaces the original module in instrument for further testing.

1. Replace instrument's module in instrument:
   - Refer to table on foldout in **MECHANICAL PROCEDURES** for location of module replacement instructions.
   - Replace substitute module in On-Site Service Kit.

2. Transfer Cal data:
   - If cal data for the substitute module has been downloaded to instrument, proceed with step **3**; otherwise, return to foldout now.

3. Switch [POWER] to Standby.

4. Remove instrument's **A20 Calibration Module** from On-Site Service Kit and connect it to **A3 Module at A3J3**.

5. Switch instrument **ON.**

**Down-Load Cal Data**

**NOTE**

This portion of the procedure down-loads the calibration data for the entire instrument. This data replaces the cal data in the instrument for the substitute module.

**CAUTION**

Sliding switch **A3S2** to its rear position unprotects the HP 8642 EEPROMs. To prevent any damage to the HP 8642 memory, carefully perform the steps in this procedure in the order which they are given.

**NOTE**

If you get off track, return **A3S2** to its protect position, switch the instrument to Standby then back ON, and begin again at step **6**.

6. When **"100.000000MZ -140.0DM** appears:
   - Slide A3S2 back toward rear of instrument. (See **INSTRUMENT WIRING DIAGRAM** on foldout to locate **A3S2**.)

7. [SHIFT] [SPCL] [3] [7] [5] [HZ]

8. When **"TRANSFER VERIFIED .U613"** appears:
   - Slide A3SZ toward front of instrument to protect instrument's memory.
   - [HZ] to end routine.

9. Switch [POWER] to **Standby.**

10. Remove **A20 Module** from Rear Panel of instrument and return it to On-Site Service Kit.

11. Remove instrument's **A20 Module** from **A3J3** and return it to Rear Panel of instrument.

12. Return to foldout.

## 4-2. CORRECTION DATA SPECIAL FUNCTIONS

### Identifying the Contents of the A20

The following is a procedure to display and identify the contents of the A20 Board.

1. Switch the HP 8642 to Standby.
2. Plug the A20 on to A3J3.
3. Switch the HP 8642 ON.
4. Key in: [SHIFT] [SPCL] [3] to enter service mode.
5. Key in: [4] [8] [HZ] to display the Module ID numbers corresponding to Valid Cal Data in the A20 board.

The A20 board can be thought of as having 10 memory locations. The address of each location (numbered 0 through 9) is the Module ID Number. Each memory location will either contain Valid Cal Data or it will be blank. The A20 addresses that contain Valid Cal Data will now be displayed. Some examples of the HP 8642 display are shown below. Refer to Table 4-1 to cross reference the A20 addresses (Module ID Numbers) to the Memory Contents.

| | |
|---|---|
| A20 containing HP 8642B Cal Data Backup: | **[VALID CAL = 0123456789 .U6191]** |
| A20 provided with A19 exchange module: | **[VALID CAL = 567 .U619]** |
| A20 provided with A6 exchange module: | **[VALID CAL = 3 .U619]** |
| *A20 containing no data: | **[VALID CAL = 0 .U619]** |

*In a newly initialized A20 board there will be data stored in location 0. The data will be Model#: HP 864, no Serial# and no Options.

**Table 4-1: Module ID Numbers.**

| ID Number | Memory Contents |
|---|---|
| 0 | Model #, Serial #, Options |
| 1 | A11 Cal Data |
| 2 | A12 Cal Data |
| 3 | A6 Cal Data |
| 4 | A13 Cal Data |
| 5 | A19 Doubler Cal Data |
| 6 | A19 Attenuator Cal Data |
| 7 | A19 Rev. Pwr. Protect, Cal Data |
| 8 | A14 Cal Data |
| 9 | A2 Cal Data |

## REPLACING A MODULE

6. Use the Service Special Functions in Table 4-2 to display the information, referred to as Cal Data Stats, for the Module ID Numbers that were displayed in step **5**. See **Interpreting Cal Data Stats** later in this section for details about the display.

**Table 4-2: HP 8642 Display for A20 Stats.**

| Module ID Number | HP 8642 Display | Service Special Function |
|---|---|---|
| 0 | Model# | 45 Hz |
| 0 | Serial # | 46 Hz |
| 0 | Options | 47 Hz |
| 1 | A11 Stats | 111Hz |
| 2 | A12 Stats | 112 Hz |
| 3 | A6 Stats | 113 Hz |
| 4 | A13 Stats | 114 Hz |
| 5 | A19 Doubler Stats | 115 Hz |
| 6 | A19 Attenuator Stats | 116 Hz |
| 7 | A19 Rev. Pwr. Protect. Stats | 117 Hz |
| 8 | A14 Stats | 118 Hz |
| 9 | A2 Stats | 119 Hz |

7. If you wish to determine which data is the same between the A20 and the A3, key in 4 4 Hz. Some examples of the HP 8642 display are:

| | |
|---|---|
| A20 with A19 exchange module before data down load: | **[CAL SAME= . U6171]** |
| A20 with A19 exchange module after data down load: | **[CAL SAME= 567 U6171]** |
| A20 with no data corresponding to the HP 8642: | **[CAL SAME= . U617]** |
| HP 8642B Cal Data Backup: | **[CAL SAME= 0123456789. U617]** |

## REPLACING A MODULE

### Identifying the Contents of the A3

The following is a procedure to display and identify the contents of the A3 Cal Data Memory.

1. Key in: [SHIFT] [SPCL] [3] to enter service mode.

2. Key in: [4] [1] [HZ] to display the Module ID number of any Valid Cal Data in the A3 Board.

   The A3 board EEPROM can be thought of as having 10 memory locations. The address of each location (numbered 0 through 9) is the Module ID Number. Each memory location will either contain Valid Cal Data or it will be blank. The A3 addresses that contain Valid Cal Data will now be displayed. Some examples of the HP 8642 display are shown below. Refer to Table 4-1 to cross reference the A3 addresses (Module ID Numbers) to the Memory Contents.

   New A3 before down loading back-up data from A20: **[VALID CAL= 0 .U619]**

   Functional HP 8642B: **[VALID CAL= 0123456789 .U619]**

3. Use the key sequence in Table 4-3 to display the cal. data stats for the module(s) you are interested in. See **Interpreting Cal Data Stats** later in this section.

**Table 4-3: A3 Cal-Data Stats Display.**

| ID Number | HP 8642 Display | Service Special Function Key Sequence for A3 |
|---|---|---|
| 0 | Model # | 40 Hz |
| 0 | Serial | 41 Hz |
| 0 | Options | 42 Hz |
| 1 | A11 Stats | 11 Hz |
| 2 | A12 Stats | 12 Hz |
| 3 | A6 Stats | 13 Hz |
| 4 | A13 Stats | 14 Hz |
| 5 | A19 Doubler Stats | 15 Hz* |
| 6 | A19 Attenuator Stats | 16 Hz |
| 7 | A19 Rev. Pwr. Protect Stats | 17 Hz* |
| 8 | A14 Stats | 18 Hz |
| 9 | A2 Stats | 19 Hz |

* If these special functions are used on an HP 8642A, "INVALID CHOICE .U670" will appear in the display.

## REPLACING A MODULE

### Interpreting Cal Data Stats

When viewing the HP 8642 Cal Data Stats you will see the Module ID Number (refer to Table 41), the word STAT, and three pieces of data. The first field to the right of STAT is the Cal Method Number. If the number is 8999, or below the Cal Data was generated at the factory. If the Cal Method Number is 9000 or greater, the Cal Data was generated using one of the Auto Adjust Routines built into the HP 8642. The second field to the right of STAT is the date that the Cal Data was generated. The date is shown in the form month, date, year (MM.DD.YY). The right most field is the five digit Cal ID Number which will conform to the last five digits of the serial number-like designator (i.e., 2412A/31458) that is on each module.

The following are some examples of the State Display on the HP 8642:

**[09 STAT 9995 02.30.84 31458]**

A2 Cal Data Stats are: Data generated using the built-in A2 Auto-Adjust Routine February 30, 1984 and the A2 module Cal ID Number is 31458.

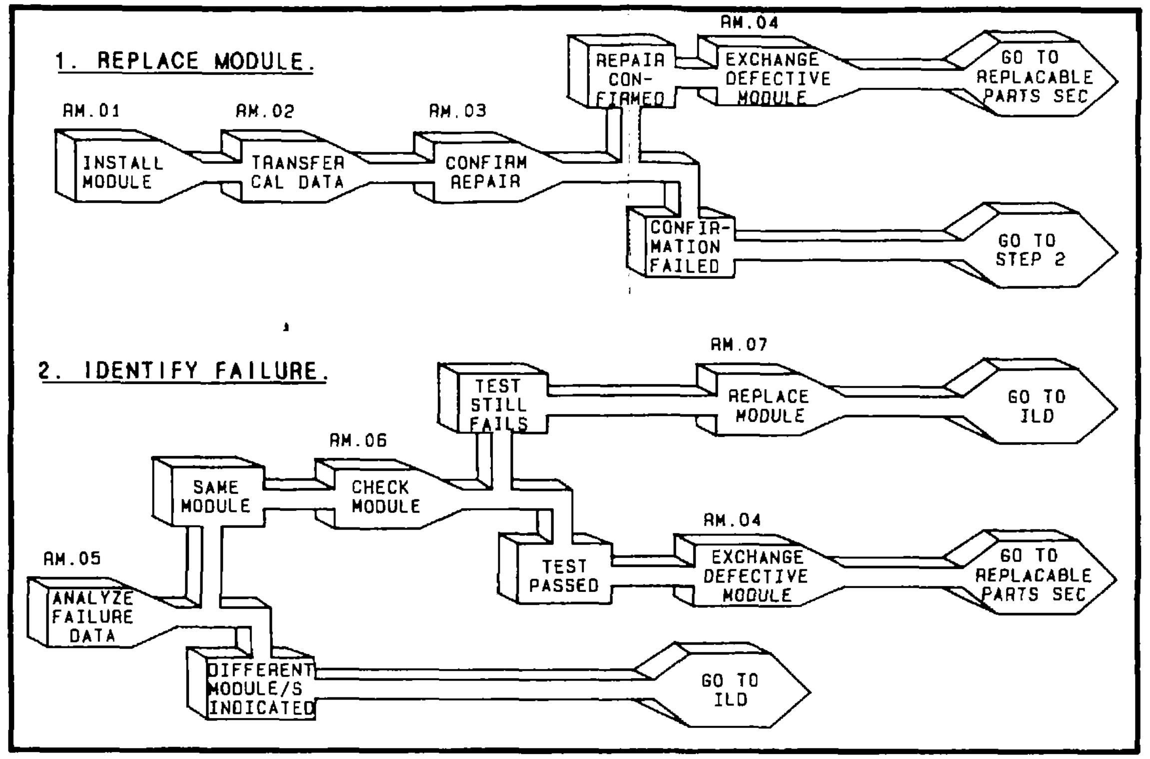
**[02 STAT 0002 12.25.86 00903]**

A12 Cal Data Stats are: Data generated at the factory on December 25, 1986 and the A12 module Cal ID Number is 00903.

**[04 STAT 0001 09.06.82 23010]**

A13 Cal Data Stats are: Data generated at the factory on September 6, 1982 and the A13 module Cal ID Number is 23010.

## MODULE REPLACEMENT




## CAL DATA TRANSFER TABLE

| Modules | | Cal Data Select Keys |
|---|---|---|
| A1 | Keyboard/LCD Display Module | No Data Required |
| A2 | Modulation Module | 9 HZ |
| A3 | Processor/Memory Module | 7 5 Hz |
| A4 | Latch Module | No Data Required |
| A6 | FM Loop/Counter/Timebase Module | 3 HZ |
| A7 | SAWR Loop Module | No Data Required |
| | | |
| A9 | IF Loop Module | No Data Required |
| A11 | Reference Loop Module | 1 HZ |
| A12 | Sum Loop/Divider Module | 2 HZ |
| A13 | Output Filters/ALC Module | 4 HZ |
| A14 | Heterodyne Module | 8 HZ |
| | | |
| A17 & A18 | Power Supply Modules | No Data Required |
| A19 | Doubler/Attenuator Module | 5 HZ 6 HZ 7 HZ |
| A20 | Down-load All Modules | 7 5 HZ |
| RPP | Reverse Power Protection | 7 HZ |

## INSTRUMENT WIRING DIAGRAM

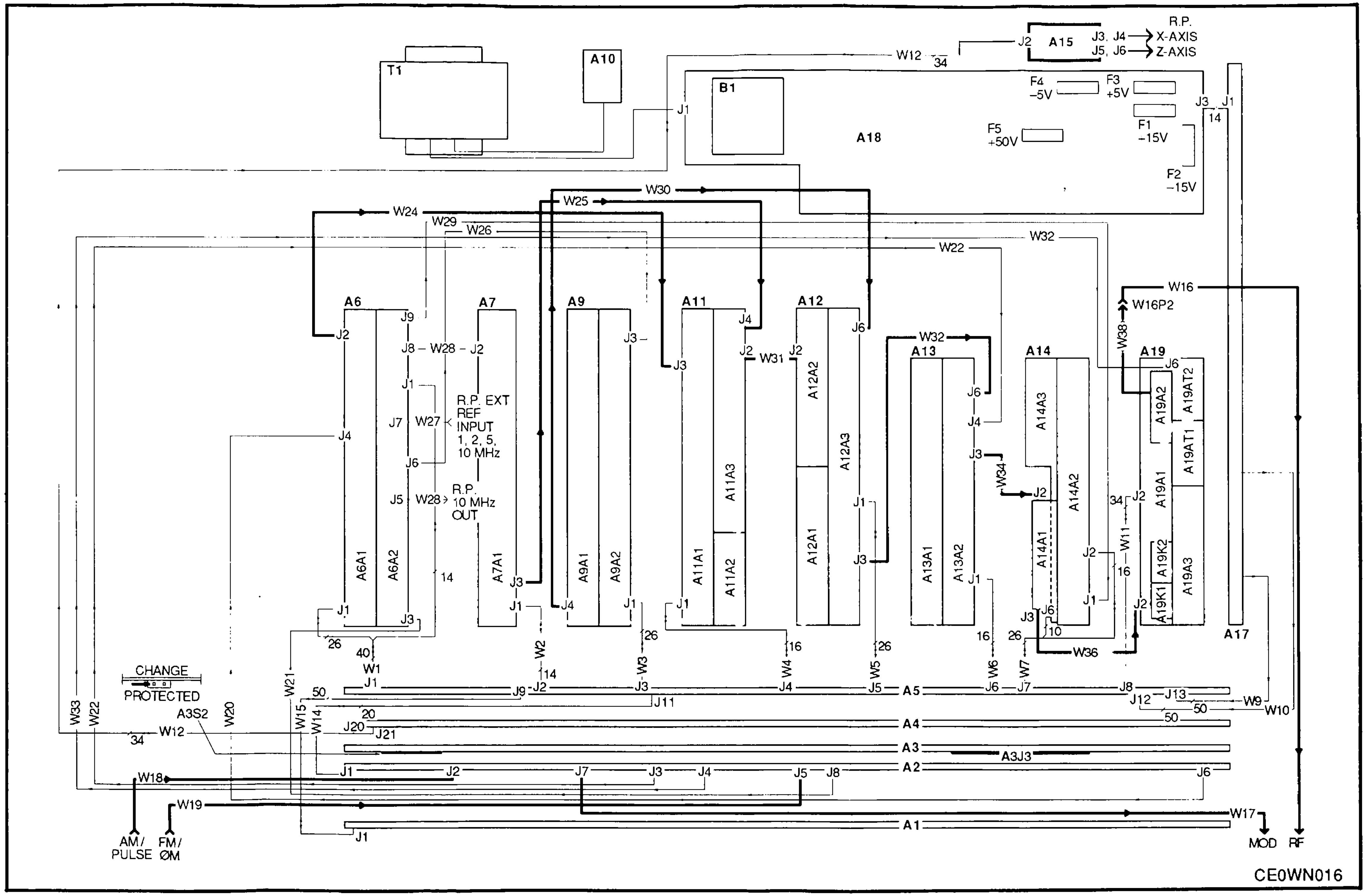



Figure 4-100. Replacing a Module.

# SECTION V. MECHANICAL PROCEDURES

## 5-1. INTRODUCTION

This section contains mechanical **procedures required for on-site service of the HP 8642 Synthesized Signal Generator. Refer to SECTION IV REPLACING A MODULE** for information regarding module calibration. Refer to instrument top cover for specific cable connection locations. The instrument should be serviced in an electrostatic discharge protected environment.

Table 5-1, located on the foldout at the end of this section, is a quick reference table for locating the paragraph in which the removal and replacement procedures for each module/assembly are found.

**NOTE**

Unless otherwise noted, the directions "left" and "right" given in the instructions are referenced as though you are looking at the instrument from the Front Panel.

**WARNING**

Servicing instructions are for use by service trained personnel only. To avoid dangerous electric shock, do not attempt to service this instrument unless you are qualified to do so.

Any interruption of the protective (grounding) conductor (inside the instrument) or disconnecting of the protective earth ground terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection.) In addition, verify that a common ground exists between the unit under test and this instrument prior to energizing either unit. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

## MECHANICAL PROCEDURES

### WARNING

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Certain procedures described in this manual are performed with power supplied to the instrument while protective covers are removed. Energy levels at certain points may, if contacted, cause personal injury. The +50 Vdc power supply level is distributed to many points throughout the instrument.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.) Do not use repaired fuses or short circuited fuseholders.

The left rear portion of the chassis becomes hot during operation. A cooling period may be desired before servicing modules in this area.

To avoid personal injury, avoid contact with the A17 heatsink when the A17 Module is extended.

The HP 8642 is extremely heavy. Do not lift or carry the instrument without assistance. If the instrument is rack-mounted, do not pull the instrument from the rack without assistance.

Remove Power before proceeding with **MECHANICAL PROCEDURES**.

### NOTE

When looking at the instrument, some of the mechanical procedures may seem intuitively obvious; however, we strongly recommend that you read through an entire procedure before performing any of the steps.

## 5-2. TOOLS

### Torxhead Screws

Most screws used in instrument are Torxhead screws. They require a torque driver and Torxhead bits (provided in On-Site Service Kit) for proper removal and installation.

**CAUTION**

To avoid damage, do not exceed the following torque limits:

Torque limit for 4 mm screws: 2.2 Nm. (Use bit T15)

Torque limit for 3 mm screws: 1.5 Nm. (Use bit T10)

To set torque limit of driver, remove cover from end of handle. Lift the key to the vertical position and turn clockwise to increase torque setting, or turn counter-clockwise to decrease torque setting. align hairline on clear bulb of driver shaft with the desired setting. Push the key back to the flat position (a very slight turn in either direction may be necessary to allow key to lock into place).

### RF Wrench

An **RF** connector wrench is located above fan on right inner wall of center rear bracket. A fuse extraction/insertion tool is located on top of rear frame of instrument near fan.

### Tools Required

The On-Site Service Kit contains most tools needed to perform an on-site service of the HP8642. The tools required to perform each mechanical procedure are listed at the beginning of the procedure. Those tools required for the procedure which are not included in the On-Site Service Kit have been printed in italics.

The following is a list of tools not contained in the kit but sometimes required for on-site service:

2 pt. Pozidrive screwdriver.
1 pt. Pozidrive screwdriver
6.0 mm open end wrench.
Small flathead screwdriver.
Small needlenose pliers
Small diagonal cutters
Soldering/Desoldering tools

## 5-3. TOP COVER

| | |
|---|---|
| Removal Time: | 2 min |
| Replacement Time: | 2 min |
| Tools Required: | *Pozidrive screwdriver.* |

**WARNING**

Certain procedures described in this manual are performed with power supplied to the instrument while protective covers are removed. Energy levels at certain points may, if contacted, cause personal injury. The +50 Vdc power supply level is distributed to many points throughout the instrument.

**CAUTION**

The instrument should not be turned on for extended periods of time with the top cover removed. The instrument's ability to cool itself is severely reduced when the top cover is removed.

**To Remove: Top Cover**

1. Remove four rear feet from rear frame of instrument by removing screw in each foot.

2. Loosen screw in middle of rear edge of top cover. This is a captive screw (attached to top cover). Loosening it will cause cover to push away from front frame.

3. Slide top cover toward rear of instrument to disengage and lift up and away. (Cover has a tight fit and may need to be worked loose.)

**To Replace: Top Cover**

1. Place cover onto top of instrument. Slide cover toward front of instrument while applying a slight downward pressure at front edge of cover. Guide into slot in top of front frame. (Cover has a tight fit and may need to be worked forward.)

2. When screw on rear edge of cover is in contact with rear frame, tighten screw. (Cover should move forward as screw is tightened.)

3. Replace four feet on rear frame, one screw in each.

## 5-4. RF MODULES: A6, A7, A9, A11-14, A19

| | |
|---|---|
| Removal Time: | 4 min |
| Replacement Time: | 8 min |
| Tools Required: | RF connector wrench |

To locate module, refer to Top View Diagram on inside of instrument top cover.

**<u>To Remove</u>: A6, A7, A9, A11-14, A19**

1. Remove top cover (refer to paragraph **5-3**).

2. Reroute obstructing coax cables around ends of module (any cables lying across top of module that would hinder lifting of module from instrument).

**NOTE**

DO NOT disconnect intramodular cables. (These are cables which connect from one point on the module to another point on the same module.) Intramodular cables must remain in place for proper module calibration.

3. Disconnect intermodular cables from module being removed. Disconnect only those cables which connect module to other parts of instrument, including ribbon cables. Use the RF connector wrench to loosen coax cable connectors.
   - To avoid damaging semi-rigid coax cables, loosen both ends of cable before disconnecting cable from module.

4. Slide L-shaped retaining clip at each end of module toward center of module to release from guide post. See diagram 1. RF MODULE MECHANICAL PARTS on foldout at end of this section.

5. Using finger loops on retaining clips, lift module from instrument.

6. Loosen the black retaining screw three turns. Slide ribbon cable from behind cable retaining screw on module slide, being careful not to damage the ribbon cable.

**<u>To Replace</u>: A6, A7, A9, A11-14, A19**

1. Clear cables from empty module slot.

2. Slide ribbon cable behind ribbon cable retaining screw on module slide. Re-tighten the screw. Pull cable up until screw rests in cable fold. (With a new cable fold may not be evident. allow enough slack in cable to accommodate lowering module into instrument.)

3. Align module slide with guide post mounted in instrument. (Modules are designed so slide will not align properly if an attempt is made to install module backwards.)

4. Using finger loops on module slides, lower module into place.

5. Align retaining clips with notch in guide posts and slide clips into notch to lock module in position.

6. Reconnect all cables. Tighten connectors finger tight, then use **RF** connector wrench to slightly tighten (1 N.m). **RF** connectors on modules are fragile and over-torquing can cause damage. (Refer to inside of instrument top cover for cable connection locations.)

**<u>To Extend</u>: (A6, A7, A9, A11-14, A19)**

1. Remove top cover (refer to paragraph **5-3**).

2. Reroute any obstructing cables around ends of module.

3. Screw extender posts into top of module guide posts.

4. Slide L-shaped retaining clip, at each end of module, toward center of module to release from guide post.

5. Slide module up to top of extender.

6. Align retaining clip with notch in extender post. Slide clip into locked position.

## 5-5. CONTROL MODULE: A3

| | |
|---|---|
| Removal Time: | 1 min |
| Replacement Time: | 1 min |
| Tools Required: | None |

**<u>To Remove</u>: A3**

1. Remove top cover (refer to paragraph 5-3).

2. Raise black extractor and white extractor to upright position. (Extractors may be difficult to raise. You may feel resistance from connectors on bottom of A3 module as you raise extractors.)

3. With extractors in upright position, pull module up, out of instrument.

**To Replace: A3**

1. Raise black extractor and white extractor to their upright position.

2. Position module so extractors are aligned with matching colored plastic guides in instrument (component side of A3 toward front of instrument).

3. Align board edges with left and right slots in plastic guides.

4. Push board into instrument holding extractors in upright position.

5. Push extractors down to lock module into notch near top of guides.

## 5-6. CONTROL MODULE: A4

| | |
|---|---|
| Removal Time: | 1 min |
| Replacement Time: | 4 min |
| Tools Required: | None |

**To Remove: A4**

1. Remove top cover (refer to paragraph 5-3).

2. Disconnect yellow, Power Meter, cable fastener from mounting hole on A11 Module.

3. Raise black extractor and white extractor to their upright position. (Extractors may be slightly difficult to raise. You may feel some resistance from connectors on bottom of the A4 module as you raise them.)

4. With extractors in upright position pull module up, out of instrument.

**To Replace: A4**

1. Check that ribbon cable shields are in place between ribbon cables on AS module and A4 slot. Check that ribbon cables and shields are not obstructing connectors into which A4 plugs.

2. Raise black extractor and white extractor to their upright position.

3. Position module so extractor colors are aligned with matching colored plastic guides in instrument (component side of A4 toward rear of instrument).

4. Align board edges with left and right slots in plastic guides.

5. Push board into instrument holding extractors in upright position. As you lower A4 Module into instrument, ensure that ribbon cables on AS Module do not become disconnected.

6. Push extractors down to lock module into notch near top of guide.

7. Replace Yellow Power Meter cable fastener in its mounting hole on the A11 Module.

## 5-7. FRONT PANEL

| | |
|---|---|
| Opening Time: | 5 min |
| Closing Time: | 4 min |
| Tools Required: | Torque driver, Torxhead bits, *small flathead screwdriver* |

Front panel assembly is mounted into front frame on a retracting hinge. The hinge mechanism, located on inside left side of Front Panel, allows right side to swing open like a door for accessing A1 and A2 Modules.

**NOTE**

This procedure requires that careful attention is paid to each step. Read through entire procedure before performing any of the steps.

**<u>To Open</u>: Front Panel**

1. Remove any adapters from **RF OUTPUT** connector on Front Panel.

2. Gently pry plastic trim strip from top of front frame by inserting a screwdriver into slots in rear edge of plastic strip.

3. On top of front frame, remove. two countersunk screws (first and thirteenth holes counting from right).

4. On bottom of frame, remove three screws (third, eighth, and twelfth holes counting from right).

**<u>CAUTION</u>**

DO NOT swing right side of panel open until entire panel is pulled out from front frame. Left (hinged) side of Front Panel may be damaged if not pulled out from frame before right side is swung open.

5. Grasping **AM INPUT** Connector (J1) and **MOD OUTPUT** Connector (J3), pull panel outward until entire Front Panel clears front frame by about 1/2 inch.

**NOTE**

If it is difficult to pull Front Panel out, it may be helpful to slightly loosen the two screws on bottom of front frame directly under RF OUTPUT connector (CP1).

6. Slowly swing right side of panel outward while carefully guiding left side of Front Panel away from left edge of frame.

**<u>To Close</u>: Front Panel**

1. While using J1 (**AM INPUT** connector) to hold left side of Front Panel away from frame, slowly swing right side of panel inward until "door" is almost closed.

2. Push left side of panel straight back into front frame, then push right side into frame.

3. Replace screws in first and thirteenth countersunk holes counting from right, in top of front frame, and screws in third, eighth, and twelfth holes in bottom of frame. (Count from right.)
   - Tighten two screws under **RF OUTPUT** connector if they were loosened when Front Panel was opened (refer to paragraph **5-8**, step **4**).

4. Press top plastic trim strip into place on top of front frame, position slot toward rear of instrument.

**5-8. Deleted**

## 5-9. RF MODULE: A2

| | |
|---|---|
| Removal Time: | 10 min |
| Replacement Time: | 15 min |
| Tools Required: | Torque driver, Torxhead bits, RF connector wrench, *diagonal cutters,* cable ties. |

A2 is mounted in the front frame of the instrument behind the Front Panel.

**To Remove: A2**

1. Open Front Panel (refer to paragraph **5-7**).

2. Disconnect coax cables from A2 Module using RF connector wrench.
   - Clip cable ties which hold cable bundle to module ties. (See diagram **4**. **A2 CABLE TIES AND CONNECTORS** on foldout at end of this section.)

3. Remove seven screws securing module to instrument.

4. Disconnect ribbon cable from A2J1, then pull A2 Module out of instrument.

**To Replace: A2**

1. Slide four new cable ties under ties already attached to A2 Module.

2. Position module with component side forward toward front of instrument. Connect ribbon cable to A2 at A2J1.

3. Secure module to metal shield. (7 screws, finger tight).
   - When all screws are in place tighten each one.

4. Connect coax cables. See instrument top cover for cable connection locations. Secure cables to module using cable ties installed in step 1.

5. Close Front Panel (refer to paragraph 5-7).

## 5-10. CONTROL MODULE: A1

| | |
|---|---|
| Removal Time: | 8 min |
| Replacement Time: | 8 min |
| Tools Required: | Torque driver, Torxhead bits, 6 mm *open end wrench.* |

A1 module consists of A1A1 Keyboard Assembly and A1A2 LCD Display Assembly. References to A1 refer to the module as a single unit. A1 is mounted onto back of hinged front panel.

**CAUTION**

When removing A1 Module, the A1A2 LCD Display can be inadvertently detached from the keyboard. Remove A1 slowly and be sure that the display is firmly in place. It is advisable to wear gloves when handling the LCD display; it is easily soiled but not easily cleaned.

The A1A2 LCD Display Assembly is extremely static sensitive. Use adequate Electrostatic Discharge Techniques when handling the A1A2 Assembly.

**To Remove: A1**

1. Open Front Panel (refer to paragraph **5-7**).

2. Remove four screws securing metal shield to back of A1 Module and pull shield off.

3. Remove ten hex nuts 6 mm securing module to Front Panel standoffs.

**CAUTION**

To avoid damage to key caps, and to avoid pulling switches loose, pull A1 away from front panel slowly, keeping key caps aligned with holes in Front Panel.

4. Pull module away from Front Panel far enough to disconnect RPG (knob) wiring harness from A1 Module at A1A1J3. RPG, Rotary Pulse Generator, is round black assembly attached to Front Panel, visible through cutout in A1A1 assembly.

5. Disconnect ribbon cable from A1 Module at A1A1J1.

6. Pull A1 Module from instrument.

**To Replace: A1**

1. Position board with component side (key caps) forward toward Front Panel.

2. Connect ribbon cable from A1 Module at A1AJ1.

3. Route RPG (knob) wiring harness through circular hole in A1 Module then back under A1 to front of A1 Module and connect harness to A1 Module at A1A1J3.

4. Align key caps with holes in Front Panel, and align mounting holes with standoffs. Gently push A1 into place on standoffs.

5. Place a hex nut on each standoff (qty 10) and tighten finger tight. When each nut is in place tighten each one.

6. Position metal shield with U-shaped cutout over RPG (knob) assembly and secure shield to Front Panel with our screws.

7. Close Front Panel (refer to paragraph **5-7**).

## 5-11. LCD DISPLAY ASSEMBLY A1A2

| | |
|---|---|
| Removal Time: | 2 min |
| Replacement Time: | 2 min |
| Tools Required: | None |

**CAUTION**

When removing A1 Module, the A1A2 LCD Display can be inadvertently detached from the keyboard. Remove A1 slowly and be sure that the display is firmly in place. It is advisable to wear gloves when handling the LCD display; it is easily soiled but not easily cleaned.

The A1A2 LCD Display Assembly is extremely static sensitive. Use adequate Electrostatic Discharge Techniques when handling the A1A2 Assembly.

**To Remove: A1A2**

1. Open Front Panel (refer to paragraph **5-7**).

2. Remove A1 Module (refer to paragraph **5-10**).

3. Lay A1 Module down flat, component side up.
   - A1A2 assembly plugs into A1 Module at A1A1J4 and A1A1JS. Grasp connectors on A1A2 Assembly and pull both upward at same time. There may be resistance as you pull but, DO NOT use a rotating or twisting action as you pull upward. Torque produced by twisting can cause damage to components or solder connections.

**To Replace: A1A2**

1. Carefully align plugs A1A2P1 and A1A2P2 on the A1A2 with connector pins of A1A1J4 and A1A1JS on the A1 Module.
   - With even pressure at both ends, carefully press display into place.

2. Replace A module in instrument (refer to paragraph **5-10**).

## 5-12. LCD DISPLAY INCANDESCENT LAMPS

| | |
|---|---|
| Replacement Time: | 10 min |
| Tools Required: | Torque driver, Torxhead bits, *Soldering iron, desoldering tool, needlenose pliers.* |

**CAUTION**

When removing A1 Module, the A1A2 LCD Display can be inadvertently detached from the keyboard. Remove A1 slowly and be sure that the display is firmly in place. It is advisable to wear gloves when handling the LCD display; it is easily soiled but not easily cleaned.

The A1A2 LCD Display Assembly is extremely static sensitive. Use adequate Electrostatic Discharge Techniques when handling the A1A2 Assembly.

**<u>To Replace</u>: Incandescent Lamp**

1. Remove A1A2 (refer to paragraph **5-11**).

2. Remove two screws securing black end cap of LCD display from end of display at which defective lamp is located. The screw on upper edge of end cap requires two washers, take care not to lose them. Remove end cap.

3. Unsolder leads of incandescent lamp, and remove lamp from mounting holes. To prevent damage to printed circuit traces and plated mounting holes, be sure leads are completely unsoldered before pulling lamp free.

4. Form leads of new lamp to fit spacing of mounting holes. Place leads in mounting holes and solder leads into place.

5. Replace black end cap over lamp, and secure from circuit side with two screws. (Screw on upper edge of end cap requires two washers.)

6. Replace A1A2 Assembly (refer to paragraph **5-11**).

## 5-13. RIGHT SIDE COVER

| | |
|---|---|
| Removal Time: | 2 min |
| Replacement Time: | 2 min |
| Tools Required: | *Pozidrive screwdriver.* |

**To Remove: Right Side Cover**

1. Remove the four feet on rear frame by removing a screw in each foot.

2. Remove top cover (refer to paragraph **5-3**).

3. Loosen screw on rear edge of right cover. This is a captive screw (attached to cover), loosening it will cause cover to push back away from front frame.

4. After screw is disengaged from frame, pull side cover from chassis being careful not to dislodge foam pieces on cover.

**To Replace: Right Side Cover**

1. Inspect side cover for loose or damaged foam, replacing it if necessary. (Foam is critical to proper A1r flow in instrument.)

2. Place groove on bottom edge of side cover onto edge of bottom cover.

3. Slide cover forward until captive screw on rear edge of side cover is in contact with rear frame. Tighten screw into frame. Cover should move forward into place as the screw is tightened.

4. Replace top cover (refer to paragraph **5-3**).

5. Replace four feet on rear frame.

## 5-14. POWER SUPPLY MODULE: A17

| | |
|---|---|
| Removal Time: | 10 min |
| Replacement Time: | 12 min |
| Tools Required: | Torque driver and Torxhead bits, *Pozidrive screwdriver.* |

**WARNING**

Left rear portion of the instrument becomes hot during operation; a cooling period may be desired before servicing.

To avoid personal injury, avoid contact with the A17 heatsink when the A17 Module is extended.

**To Remove: A 17**

1. Remove power to instrument by disconnecting line power cord.

2. Remove top cover (refer to paragraph **5-3**).

3. Remove right side cover (refer to paragraph **5-13**).

4. Remove power supply top cover from right-rear corner of instrument (one screw).

5. Remove 13 screws on side frame shown in diagram **2. A17 MODULE MECHANICAL PARTS** on the foldout at end of this section.

6. Lift module partially out of instrument to expose ribbon cable connectors through gap in side frame. Push levers on ribbon cable connectors apart to release ribbon cables from A17 Module.

7. Disconnect power supply wiring harness (W13) from A17 Module at A7J1 (located toward rear of instrument, below heatsink).

8. Lift module out of instrument.

**NOTE**

You may feel resistance as you pull the board upward. This may be caused by one of the foam strips adhered to the circuit side of the board. Apply slow, firm upward pressure.

**To Replace: A17**

1. Position component side of board toward outside of instrument.

2. Connect power supply wiring harness (W13) to A17 connector below heatsink.

3. Lower board into place.

**NOTE**

You may feel resistance as you lower board into place. This may be caused by one of the foam strips adhered to the circuit side of the board. Use slow, firm downward pressure to install board.

4. Connect ribbon cable W9 08642-60013 to A17J3, and W10 08642-60012 to A17J2. (Part numbers of these cables are stamped on cable.)

5. Foam strip adhered to circuit side of board should overlap metal bracket in such a way as to seal gap between bracket and A17.

6. Align module with screw holes. Replace 13 screws finger tight. When all screws are in place, tighten each one. (Refer to diagram **2. A17 MODULE MECHANICAL PARTS** on foldout at end of this section.)

7. Replace side cover (refer to paragraph **5-13**).

**To Extend: A17**

1. Remove power to instrument by disconnecting line power cord.

2. Remove top cover (refer to paragraph **5-3**).

3. Remove power supply top cover, one screw.

4. Remove screws shown in diagram **2. A17 MODULE MECHANICAL PARTS** on foldout at the end of this section.

5. Lift module partially out of instrument to expose ribbon cable connectors (A17J2 and A17J3) through gap in side frame. Push levers on ribbon cable connectors apart to release ribbon cables W9 and W10.
   - Be sure the power supply wiring harness W13 remains connected to A17 and A18.

6. Pull module up until lower mounting holes on A17 Module are aligned with mounting holes in top rail of frame.

7. Insert screws into bottom mounting holes on A17 through holes in top rail and tighten finger tight. When all screws are in place, tighten each one.

8. Connect ribbon cable W9 08642-60013 to A17J3, and W10 08642-60012 to A17J2. (Part numbers of these cables are stamped on the cable.)

9. Reconnect power to instrument.

## 5-15. REAR BOTTOM COVER

| | |
|---|---|
| Removal Time: | 5 min |
| Replacement Time: | 3 min |
| Tools Required: | *Pozidrive screwdriver, small flat head screwdriver, insulated screwdriver* |

To access A18 Module only REAR bottom cover need be removed. All other modules are accessible through top of instrument.

**CAUTION**

Do not remove the center bottom cover, Its placement is important to the structural stability of instrument. All on-site serviceable parts in the center section of instrument are accessible through top of the instrument.

Remove line power cord before removing rear bottom cover.

**To Remove: Rear Bottom Cover**

1. Remove power to instrument by disconnecting line power cord.

2. Remove four feet on rear frame by removing a screw in each foot.

3. Turn instrument on its side and remove two rear feet from bottom cover.

4. Unscrew four screws on front edge of rear bottom cover.

5. Slide cover toward rear of instrument and lift cover from instrument. (Cover fits snugly and may need to be worked loose.)

**WARNING**

Capacitors on the A18 Module may still be charged even if the instrument has been disconnected from its source of power. Use a conductor with an insulated handle, such as a screw driver, to discharge capacitors by carefully grounding capacitor terminal screws, on bottom of A18 Module, to instrument's chassis.

**To Replace: Rear Bottom Cover**

**CAUTION**

Remove line power cord before replacing rear bottom cover.

1. Slide rear bottom cover forward from rear of instrument and align holes in front edge of rear cover with holes rear edge of center bottom cover.

2. Insert and tighten four screws.

3. Replace two rear feet on bottom of instrument.

4. Replace four feet on rear frame.

## 5-16. POWER SUPPLY MODULE: A18

| | |
|---|---|
| Removal Time: | 10 min |
| Replacement Time: | 10 min |
| Tools Required: | Torque driver and Torxhead bits, *insulated screwdriver.* |

**WARNING**

Do not operate the instrument with the A18 Module detached from chassis. The screws securing the A18 Power Supply Rectifier and Filter Module to the chassis are an integral part of the protective grounding of the instrument.

## MECHANICAL PROCEDURES

**WARNING**

The left rear portion of the instrument becomes heated during operation and a cooling period may be desired before servicing.

Capacitors on the A18 Module may still be charged even if the instrument has been disconnected from its source of power. Use a conductor with an insulated handle, such as a screw driver, to discharge capacitors by carefully grounding capacitor terminal screws, on bottom of A18 Module, to instrument's chassis.

**To Remove: A18**

1. Remove power to instrument by disconnecting line power cord.

2. Remove top cover (refer to paragraph **5-3**).

3. Remove power supply top cover, one screw.

4. Remove bottom rear cover (refer to paragraph **5-15**.)

5. Using insulated screwdriver, discharge capacitors by carefully grounding mounting terminal screws on, bottom of A18 Module, to instrument's chassis.

6. Remove screws on bottom of A18 Module shown in diagram **4. A18 MODULE MOUNTING SCREWS** on foldout at end of this section.

7. Guide module out through bottom of instrument until connecting wires become accessible by gently pushing from top side instrument.

8. Disconnect transformer output cable from A18 Module at A18J1. Disconnect cable to fan from A18 Module at A18J2. Disconnect wiring harness to A17 at A18J3.

**To Replace: A18**

1. Reconnect all cables removed in paragraph **5-16**, step **8**.

2. Guide module into position through bottom of instrument, and hold in place. Be sure Air seal foam and rubber strips are inside instrument (should not overlap on outside). Foam and rubber strips are easily torn and can cause difficulty when positioning module. If necessary, re-position the module in instrument to ensure a proper seal has been attained.

3. Align A18 board with screw holes in chassis and secure screws finger tight. Use star washers on all screws. When all screws are in place tighten each one. (See diagram **4. A18 MODULE MOUNTING SCREWS** on foldout at end of this section.)

4. Replace bottom cover (refer to paragraph **5-15**).

5. Replace power supply top cover, one screw.

## 5-17. CALIBRATION MODULE A20

| | |
|---|---|
| Removal Time: | 3 min |
| Replacement Time: | 3 min |
| Tools Required: | *Small flathead screwdriver.* |

**To Remove: A20**

1. Find A20 Calibration Module cover on rear panel of instrument and pull outward (plungers do not detach from fasteners). Pull away A20 Calibration Module cover. (See diagram **3. A20 and B1 MECHANICAL PARTS** on foldout at end of this section.

2. Four plastic fasteners hold Calibration Module to fan access cover on rear panel. Turn screw heads 1/4 turn to close fastener shoulders.

3. Pull Calibration Module off of fasteners. Fasteners will stay in place on fan access cover.

## MECHANICAL PROCEDURES

**To Replace: A20**

1. Check that 1/4-turn fasteners on fan access cover are in unlocked (shoulders closed) position. Push Calibration Module onto fasteners. (See diagram 3**. A20 and B1 MECHANICAL PARTS** on foldout at end of this section.)

2. Turn fasteners 1/4 turn (shoulders open) to secure Calibration Module to access cover.

3. Align plastic fasteners on Calibration Module cover with mounting holes in rear panel.
   - Push fastener sockets into mounting holes and push the fastener plungers in.

**5-18. Deleted.**

## 5-19. FAN (B1)

| | |
|---|---|
| Removal Time: | 6 min |
| Replacement Time: | 8 min |
| Tools Required: | Torque driver, torxhead bits |

**To Remove: B1**

1. Find A20 Calibration Board cover on rear panel of instrument. Remove Calibration Board cover by pulling outward on plastic fastener plungers. (See diagram **3. A20 and B1 MECHANICAL PARTS** on foldout at end of this section.)

2. Disconnect line power from instrument. Fan access cover attaches to rear panel behind Calibration Board cover. Remove four screws in fan cover securing it to rear panel.

3. Fan is mounted to access cover. Pull access cover and attached fan out of instrument.

4. Disconnect fan wire from A18 Module at A18J3.

5. Remove two screws that attach fan to rear fan mounting bracket on access cover (one in upper right corner, one in lower left corner).

**To Replace: B1**

1. Mount fan to rear fan mounting bracket on fan access cover with two screws as shown in diagram **3. A20 and B1 MECHANICAL PARTS** on foldout at end of this section. (Air directional arrows point down and to right.)

2. Route wire through rear panel to connector A18J3. (Align with black wire toward large filter capacitors on A18 module).

3. Guide fan through access hole in the rear panel. The wire to A18J3 wraps around corner of fan and may become disconnected when fan is pushed into instrument if wire is not routed under fan.

4. Replace screws securing access cover to rear panel.

5. Replace Cal Board Cover. (Refer to paragraph **5-17, To Replace: A20**, step **3.**)

## 5-20. A5 RIBBON CABLES (W1-W8, W11, W14, W15)

| | |
|---|---|
| Removal Time: | 3 min per cable |
| Replacement Time: | 5 min per cable |
| Tools Required: | Torque driver, torxhead bits, *small flathead screwdriver.* |

**To Disconnect: W1-8, W11**

1. Remove A4 (refer to paragraph **5-6**).
   - Ribbon cables, W1, W8,W11, W14 and W15 are protected by the ribbon cable shields. Flip plastic, ribbon cable shields up to expose ribbon cable connectors.
   - Shields are pliable, and can be bowed slightly to raise them.

2 Cable connectors A5J1-8 (upper row of connectors) are positioned with their pins pointing downward.
   - To free cables from connectors on A5, push the cable plug downward.

**To Reconnect: W1-W8, W11**

1. Remove A4 (refer to paragraph **5-6**).

2. Route cable over top of A5 and curl cable so plug is under its A5 connector and align plug with connector pins.

3. Push plug upward onto connector.

4. Reposition ribbon cable shields (if moved).

5. Replace A4 (refer to paragraph **5-6**).

**__To Remove__: W1-W8, W11**

1. Repeat **__To Disconnect__: W1-8, 11** steps **1-2**.

2. Clip cable ties securing retaining bar to A5 Module.

3. Extend RF module to which cable being removed is attached (refer to paragraph **5-4**).

4. Loosen the black retaining screw two or three turns. Slide cable from behind ribbon cable retaining screw on module slide bracket. (See diagram **1. RF MODULE MECHANICAL PARTS** on foldout at end of this section.)

5. Disconnect cable from connector on RF Module.

**__To Replace__: W1-8, W11**

1. Extend RF Module to which cable attaches. (Refer to paragraph **5-4**.)

2. Plug cable into connector on RF Module. (Match arrow on cable connector with arrow on module connector.)

3. Slide cable behind ribbon cable retaining screw on module slide bracket. Re-tighten the retaining screw. (See diagram **1. RF MODULE MECHANICAL PARTS** on foldout at end of this section.)

4. Repeat **__To Reconnect__: W1-8, W11**, steps **1-4**.

5. Lower RF Module into instrument.

6. Tie wrap the retaining bar to the A5 Module to hold all ribbon cables in place.

7. Replace A4 (refer to paragraph **5-6**).

**To Disconnect: W14, W15**

Cable W15 is split and routed to two connectors on A5, A5J9 and A5J10. W14 connects to A5J11.

1. Remove Modules A3 and A4 (refer to paragraphs 5-5 and 5-6).
2. Flip plastic ribbon cable shield up to expose ribbon cable connectors under it.
   - Shield is pliable, and can be bowed slightly to raise it.
3. Insert a flat head screwdriver between plastic retaining clip and connector body. Gently pry retaining clip away from AS connector and cable plug.
4. Disconnect cable from connector.

**To Reconnect: W14, W15**

1. Align cable plug with A5 connector and push plug onto connector pins.
2. Insert notched edge of the retaining clip into slot on A5 connector. Push the smooth edge of clip over end of cable plug to lock plug into position.
3. Replace ribbon cable shield.

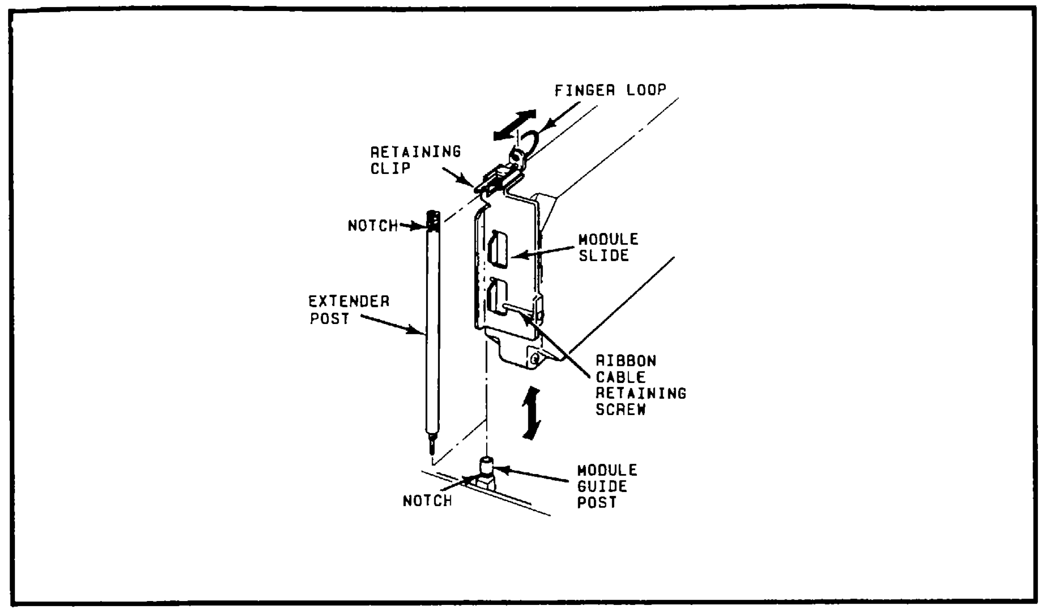
**To Remove: W14, W15**

Due to extensive instrument disassembly required to access these cables, these cables are not considered to be On-Site replaceable.

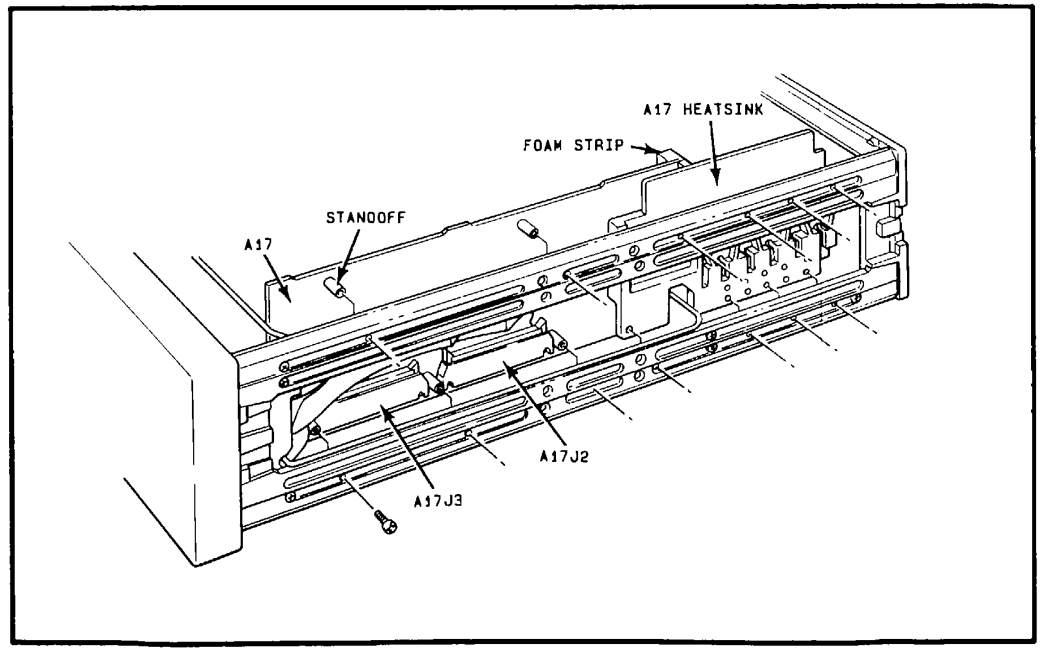
## TABLE OF MECHANICAL PROCEDURES

| Read all introductory information in paragraph "5-1. Introduction" before performing any of the procedures called out below. | | |
|---|---|---|
| **Removal/Replacement Procedure** | **Instrument Section** | **Paragraph Number** |
| A1 Keyboard/LCD Display Module<br>A1A2 LCD Display Module<br>Incandescent Lamps | Control | 5-10<br>5-11<br>5-12 |
| A2 Modulation Module | RF | 5-9 |
| A3 Processor/Memory Module<br>A4 Latch Module | Control | 5-5<br>5-6 |
| A6 FM Loop/Counter/Timebase Module<br>A7 SAWR Loop Module<br>A9 IF Loop Module<br>A11 Reference Loop Module<br>A12 Sum Loop/Divider Module<br>A13 Output Filters/ALC Module<br>A14 Heterodyne Module | RF | 5-4<br>5-4<br>5-4<br>5-4<br>5-4<br>5-4<br>5-4 |
| A17 Power Supply Regulators/ Attenuator Drivers Module<br>A18 Power Supply Rectifier/ Filters Module | Power Supply | 5-14<br>5-16 |
| A19 Doubler/Attenuator Module | RF | 5-4 |
| A20 Calibration Module | Control | 5-17 |
| Module Extension<br>A6, A7, A9, A11-A14, A16, A19,<br>A17<br>Fan (B1)<br>Top Cover<br>Rear Bottom Cover<br>Right Side Cover<br>Front Panel<br><br>A5 Ribbon Cables | | <br>5-4<br>5-14<br>5-19<br>5-3<br>5-15<br>5-13<br>5-7<br>5-8<br>5-30 |

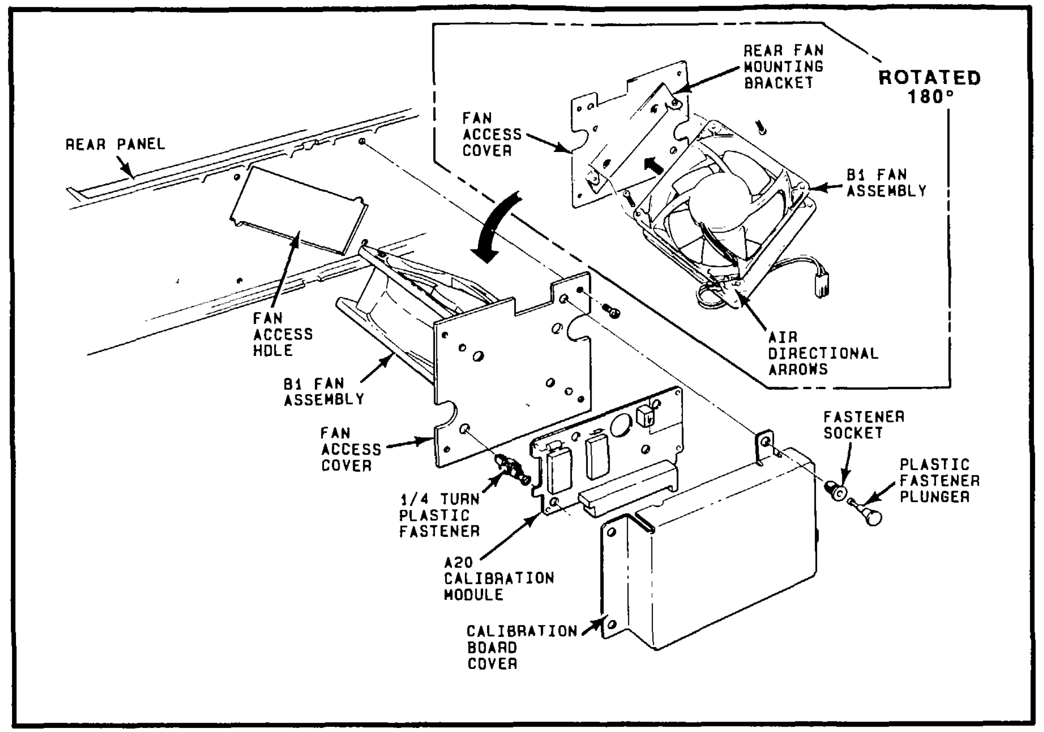
1. RF MODULE MECHANICAL PARTS



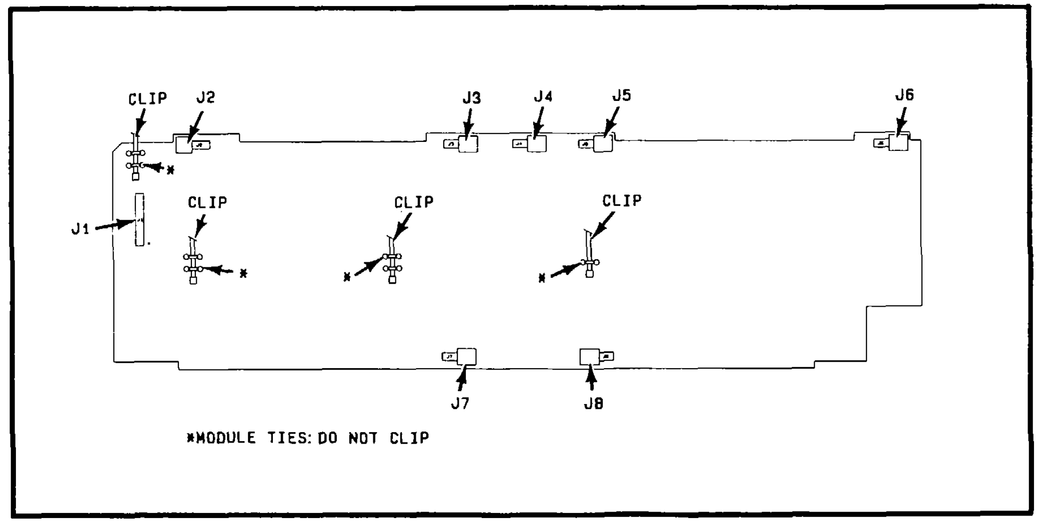

2. A17 MODULE MECHANICAL PARTS




3. A20 AND B1 MECHANICAL PARTS




4. A2 CABLE TIES AND CONNECTORS




5. A18 MOUNTING SCREWS

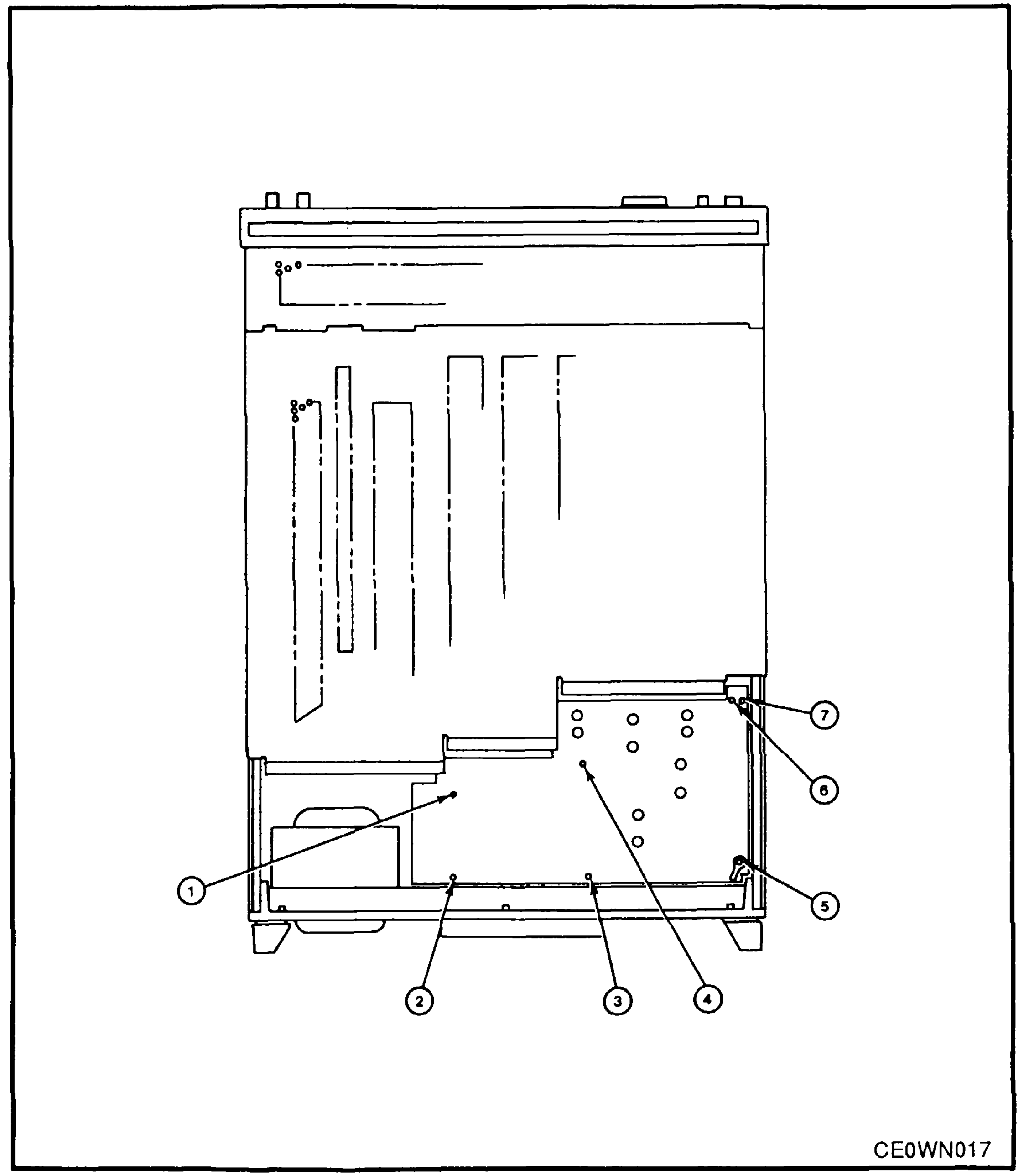



**Figure 5-100. Mechanical Procedure Diagrams**

# SECTION VI. PERFORMANCE TESTS AND ADJUSTMENTS

## 6-1. PERFORMANCE TEST.

### DESCRIPTION

This procedure covers:

- RF Power Test
- RF Harmonics Test
- Pulse ON/OFF Ratio Test
- Pulse Rise/Fall Test
- Residuals Test
- AM Test
- AM Depth Test
- FM Test
- FM Deviation Test

**NOTE**

- Performance test procedure steps should be done in the order given.

- Performance test specifications are provided in each performance test procedure.

- Allow an initial 30 minute warm-up period when performing the first performance test to allow the Signal Generator to stabilize.

- Allow Level Meter 5 minutes to stabilize if turned off during the performance tests.

- The initialized setup of Signal Generator controls and indicators is to be performed prior to each performance test.

- The required test equipment is listed in paragraph 0-10.

## *INITIALIZED SETUP*

1. Press INSTR PRESET.

2. Verify Signal Generator is as follows:

| | |
|---|---|
| RF Frequency | 100MHz |
| Start Frequency | OFF(100MHz) |
| Stop Frequency | OFF(100.1MHz) |
| Frequency Reference | OFF(100MHz) |
| Amplitude | ON(-140dBm) |
| Start Amplitude | OFF(-140dBm) |
| Stop Amplitude | OFF(-135dBm) |
| Amplitude Reference | OFF1.0µV) |
| EMF Mode | OFF |
| AM Depth | OFF(50% Internal) |
| FM Deviation | OFF(50KHz Internal) |
| Phase Deviation | OFF(1.0 radians Internal) |
| Pulse Modulation | OFF(External DC Source) |
| Modulation Frequency | 1.0KHz |
| Modulation Output Level | OFF (1V) |
| Frequency Sweep Mode | AUTO |
| Amplitude Sweep Mode | AUTO |
| Sweep Time | 500msec |

## *RF POWER TEST*

DESCRIPTION: RF Power level output is checked at levels that can be read accurately by a Low Frequency Spectrum Analyzer (at 450KHz), and Power Meter and Thermistor Mount (>10MHz).

EQUIPMENT REQUIRED: Power Meter.
Thermistor Mount.
10dB Attenuator.
Low Frequency Spectrum Analyzer.
Type N Cable.

1. Connect Low Frequency Spectrum Analyzer to Signal Generator RF Output Connector using 10dB Attenuator and type N cable.

2. On Signal Generator,

| | |
|---|---|
| Press | INSTR PRESET |
| Set Frequency to | 0.450MHz |
| Set AMPTD to | +13dBm |

***RF POWER TEST-Continued***

3. On Low Frequency Spectrum Analyzer:

Press ........................................................ INSTR PRESET
CENTER FREQUENCY.............................. 450KHz
FREQUENCY SPAN .................................. 500KHz
Adjust reference level so peak is 5dB below top graticule
DB/DIV ...................................................... 2dB
SWEEP TIME............................................. 5 sec

4. Verify reading is +3dBm +1.5dB as displayed on Low Frequency Spectrum Analyzer display.

5. Remove 100dB Attenuator.

6. Repeat steps 2 thru 4 using Signal Generator RF Frequency and RF Power values given in the table below. Verify that the power is within specified limits as displayed on Low Frequency Spectrum Analyzer display.

| SIGNAL GENERATOR RF FREQ (MHz) | SIGNAL GENERATOR RF POWER (dBm) | LOWER LIMIT (dBm) | UPPER LIMIT (dBm) |
|---|---|---|---|
| 0.450 | +5.00 | +3.00 | +7.00 |
| 0.450 | 0.00 | -2.00 | +2.00 |
| 0.450 | -5.00 | -7.00 | -3.00 |
| 0.450 | -15.00 | -17.00 | -13.00 |
| 0.450 | -25.00 | -27.00 | -23.00 |

7. Connect Power Meter using Thermistor Mount to 10dB Attenuator. Connect 10dB Attenuator Input to Signal Generator RF Output Connector.

8. On Signal Generator press INSTR PRESET and set AMPTD to +13dBm.

9. Set Signal Generator RF Frequency values given in the table below. Verify that the power is within specified limits as displayed on Power Meter.

| SIGNAL GENERATOR RF FREQ (MHz) | LOWER LIMIT (dBm) | UPPER LIMIT (dBm) |
|---|---|---|
| 10.000 | 1.50 | 4.50 |
| 100.000 | 1.50 | 4.50 |
| 500.000 | 1.50 | 4.50 |
| 1000.00 | 1.50 | 4.50 |
| 2000.00 | 1.50 | 4.50 |

***RF POWER TEST-Continued***

10. Turn RF OUTPUT to OFF, remove 10 dB Attenuator, and reconnect Thermistor Mount to Signal Generator RF Output. Turn RF OUTPUT to ON.

11. Set Signal Generator RF Frequency and RF Power values given in the table below. Verify that the power is within specified limits as displayed on Power Meter.

| SIGNAL GENERATOR RF FREQ (MHz) | SIGNAL GENERATOR RF POWER (dBm) | LOWER LIMIT (dBm) | UPPER LIMIT (dBm) |
|---|---|---|---|
| 100.000 | +5.00 | +3.00 | +7.00 |
| 100.000 | 0.00 | -2.00 | +2.00 |
| 100.000 | -5.00 | -7.00 | -3.00 |
| 100.000 | -15.00 | -17.00 | -13.00 |
| 100.000 | -25.00 | -27.00 | -23.00 |
| 2000.000 | +5.00 | +3.00 | +7.00 |
| 2000.000 | 0.00 | -2.00 | +2.00 |
| 2000.000 | -5.00 | -7.00 | -3.00 |
| 2000.000 | -15.00 | -17.00 | -13.00 |
| 2000.000 | -25.00 | -27.00 | -23.00 |

***RF HARMONICS TEST***

DESCRIPTION: Using a Spectrum Analyzer, 2nd and 3rd harmonics, and sub-harmonic levels are checked where harmonic performance levels are most likely to occur.

EQUIPMENT REQUIRED: Spectrum Analyzer.
One Type N 50Ω cable.

1. Connect Spectrum Analyzer 50f Input to Signal Generator RF Output Connector using 50Ω Type N cable.

2. On Signal Generator press INSTR PRESET and set AMPTD to +13dBm.

3. Set Spectrum Analyzer Controls as follows:
TIME/DIV...................................................... AUTO
TRIGGERING.............................................. FREE RUN
VERTICAL DISPLAY .................................... 10dB/DIV
VIDEO FILTER............................................. WIDE
AUTO RESOLUTION ................................... ON
REFERENCE LEVEL ................................... 18dBm
MIN RF ATTEN ........................................... 20dB

***RF HARMONICS TEST-Continued***

4. Set Signal Generator RF Frequency and Spectrum Analyzer frequency and frequency span/DIV controls to values given in the table below. Verify that the signal(s) (2nd and 3rd harmonics, or the sub-harmonics) are below specified limits as displayed on Spectrum Analyzer.

| SIGNAL GENERATOR | SPECTRUM ANALYZER | | UPPER |
|---|---|---|---|
| RF FREQ (MHz) | FREQ (MHz) | SPAN/DIV (MHz) | LIMIT (dBm) |
| 0.450 | 0.900 | 0.050 | -12.0 |
| 500.000 | 1000.000 | 75 | -12.0 |
| 2000.000 | 4000.000 | 250 | -12.0 |
| 2000.000 | 1000.000 | 50 | -7.0 |

***PULSE ON/OFF RATIO TEST***

DESCRIPTION: Using a Spectrum Analyzer, the pulse ON/OFF ratio is measured in the pulse mode.

EQUIPMENT REQUIRED: Spectrum Analyzer.
One Type N 50Ω cable.

1. Connect Spectrum Analyzer 50 Input to Signal Generator RF Output Connector using 50Q Type N cable.

2. On Signal Generator,
Press .......................................................... INSTR PRESET
Set AMPTD to ............................................ +13dBm
Set Frequency to ........................................ 1GHz
Press .......................................................... PULSE (AM)
Press .......................................................... EXT DC
Press .......................................................... SHIFT

3. Set Spectrum Analyzer Controls as follows:
TIME/DIV..................................................... AUTO
TRIGGERING............................................... FREE RUN
VERTICAL DISPLAY ................................... 10dB/DIV
VIDEO FILTER............................................ WIDE
AUTO RESOLUTION ................................. ON
REFERENCE LEVEL .................................. 18dBm
MIN RF ATTEN ........................................... 20dB
FREQUENCY ............................................... 1GHz
FREQUENCY SPAN/DIV............................. 50MHz

***PULSE ON/OFF RATIO TEST-Continued***

4. Set marker to 1GHz and verify that the measured power is below -22.0dBm as displayed on Spectrum Analyzer.

## ***PULSE RISE/FALL TEST***

DESCRIPTION: Using an Oscilloscope, the pulse rise/fall time is measured with an external pulse applied to the Signal Generator.

EQUIPMENT REQUIRED: Oscilloscope Mainframe.
Oscilloscope Plug-In.
Pulse Generator.
Two 50Ω BNC cables.
One TYPE N to BNC adapter.

1. Connect Pulse Generator output to Signal Generator Pulse input on rear panel using 50Ω BNC cable. Connect Signal Generator RF output to Oscilloscope channel 1 input using Type N to BNC adapter and 50Ω BNC cable.

2. On Signal Generator,

| | |
|---|---|
| Press | INSTR PRESET |
| Set AMPTD to | +13dBm |
| Set Frequency to | 1GHz |
| Press | EXT DC |
| Press | SHIFT |
| Press | PULSE (AM) |

3. Set Pulse Generator Controls as follows:

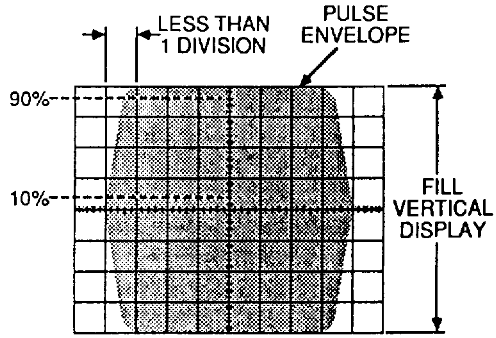
| | |
|---|---|
| MODE | NORM |
| PERIOD | 20 µsec |
| WIDTH | 6 µsec |
| AMPLITUDE | 5 volts |

4. Set Oscilloscope Controls as follows:

| | |
|---|---|
| CH1 VOLTS/DIV | 0.1V |
| SEC/DIV | 0.5µsec |
| CH1 | BUTTON IN |
| SWP | BUTTON OUT |
| INT CH1 | BUTTON IN |
| AUTO TRIG | BUTTON IN |

**PULSE RISE/FALL TEST-Continued**

5. Adjust Oscilloscope delayed sweep controls so that the leading edge of the pulse envelope is within the first two divisions of the display. Adjust the CH1 VOLTS/DIV and DC OFFSET controls so that the pulse envelope fills the vertical range of the display.




6. Verify that the pulse envelope (on the positive and negative side) rises from 10% to 90% of its final value in less than 1 division as shown on the Oscilloscope display.

***RESIDUALS TEST***

DESCRIPTION: Residuals are demodulated and measured by the Modulation Analyzer using either AM or FM mode.

EQUIPMENT REQUIRED: Modulation Analyzer.
One TYPE N 50Ω cable.
Digital Voltmeter.

1. Connect Signal Generator RF output to Modulation Analyzer input using 50Ω Type N cable.

2. On Signal Generator press INSTR PRESET and set AMPTD to +13dBm.

3. Set Modulation Analyzer Controls as follows:
Enter ........................................................ 41.0 SPCL
MEASUREMENT....................................... FM
Ω LP FILTER ................................................ 3KHz

4. Set Signal Generator RF Frequency to values given in the table below. Verify that the reading is below specified limits as displayed on Modulation Analyzer.

| SIGNAL GENERATOR RF FREQ (MHz) | UPPER LIMIT (KHz) |
|---|---|
| 500.000 | 0.005 |
| 1000.000 | 0.010 |
| 1300.000 | 0.020 |

***RESIDUALS TEST-Continued***

5. Set Modulation Analyzer Measurement Mode to AM.

6. Connect Digital Voltmeter to MOD OUTPUT connector on Modulation Analyzer. Set Digital Voltmeter mode to AC.

7. Set Signal Generator RF Frequency to values given in the table below. Verify that the reading is below specified limits as displayed on Digital Voltmeter.

| SIGNAL GENERATOR RF FREQ (MHz) | UPPER LIMIT (mV) |
|---|---|
| 1000.000 | 0.18 |
| 1300.000 | 0.18 |

***AM TEST***

DESCRIPTION: Incidental FM and AM Distortion are measured using the Modulation Analyzer and Distortion Analyzer.

EQUIPMENT REQUIRED: Modulation Analyzer.
Distortion Analyzer.
One TYPE N 50Ω cable.
Two 50Ω BNC cables.
One BNC to dual banana adapter.

1. Connect Signal Generator RF output to Modulation Analyzer input using 50Ω Type N cable. Connect Signal Generator MOD OUTPUT to AM input using 50Ω BNC cable. Connect Modulation Analyzer MOD OUTPUT to Distortion Analyzer Input using 50Ω BNC cable and BNC to dual banana adapter.

2. On Signal Generator,
Press ........................................................ INSTR PRESET
Set AMPTD to ............................................ +13dBm
Set Frequency to ........................................ 1GHz
Press ........................................................ AM
Press ........................................................ EXT DC
Set AM to .................................................. 30%
Set MOD OUT to ........................................ 1V

***AM TEST-Continued***

3. Set Modulation Analyzer Controls as follows:
   Enter ........................................................ 41.0 SPCL
   MEASUREMENT....................................... FM
   HP FILTER................................................ 300Hz
   LP FILTER ................................................ 3KHz

4. Verify that the incidental FM is less than 200Hz as shown on the Modulation Analyzer.

5. Set Modulation Analyzer Controls as follows:
   MEASUREMENT....................................... AM
   HP FILTER................................................ OFF
   LP FILTER ................................................ OFF

6. Set Signal Generator RF controls as given in the table below. Verify that the reading is below specified limits as displayed on Distortion Analyzer.

**NOTE**
**Tune Distortion Analyzer to Modulation Frequency shown below.**

| SIGNAL GENERATOR CONTROLS PRESS | | | | | | UPPER LIMIT (%) |
|---|---|---|---|---|---|---|
| MOD FREQ | 20 | Hz | AM | 90 | % | 5.0 |
| MOD FREQ | .4 | KHz | AM | 70 | % | 3.0 |
| MOD FREQ | 1 | KHz | AM | 30 | % | 1.5 |
| MOD FREQ | 20 | KHz | AM | 90 | % | 5.0 |

***AM DEPTH TEST***

DESCRIPTION: AM Depth is measured using the Modulation Analyzer.

EQUIPMENT REQUIRED: Modulation Analyzer.
One TYPE N 50Ω cable.

1. Connect Signal Generator RF output to Modulation Analyzer input using 50Ω Type N cable.

2. On Signal Generator press INSTR PRESET and set AMPTD to +13dBm.

***AM DEPTH TEST-Continued***

3. Set Modulation Analyzer Controls as follows:
   Enter ........................................................ 41.0 SPCL
   MEASUREMENT....................................... AM
   LP FILTER ................................................ >20KHz

4. Set Signal Generator controls to values given in the table below. Verify that the AM reading is within specified limits as displayed on Modulation Analyzer.

SIGNAL GENERATOR MINIMUM

| SIGNAL GENERATOR | | | MINIMUM |
|---|---|---|---|
| RF FREQ (MHz) | MOD FREQ (KHz) | AM (%) | AM (%) |
| 0.45 | 0.020 | 99 | 90.0 |
| 10.00 | 0.4 | 99 | 90.0 |
| 100.00 | 1.0 | 99 | 90.0 |
| 1000.00 | 10.0 | 99 | 90.0 |
| 1000.00 | 20.00 | 99 | 90.0 |

## *FM TEST*

DESCRIPTION: Incidental AM and FM Distortion are measured using the Modulation Analyzer and Distortion Analyzer.

EQUIPMENT REQUIRED: Modulation Analyzer.
Distortion Analyzer.
One TYPE N 50Ω cable.
Two 50Ω BNC cables.
One BNC to dual banana adapter.

1. Connect Signal Generator RF output to Modulation Analyzer input using 50Ω Type N cable. Connect Signal Generator MOD OUTPUT to FM/∅M input using 50Ω BNC cable. Connect Modulation Analyzer MOD OUTPUT to Distortion Analyzer Input using 50Ω BNC cable and BNC to dual banana adapter.

2. On Signal Generator,
   Press.......................................................... INSTR PRESET
   Set AMPTD to ........................................... +13dBm
   Set Frequency to ....................................... 1GHz
   Press.......................................................... FM
   Press.......................................................... EXT DC
   Set MOD OUT to........................................ 1V

***FM TEST-Continued***

3. Set Modulation Analyzer Controls as follows:
   Enter .......................................................... 41.0 SPCL
   MEASUREMENT....................................... AM
   HP FILTER................................................ 300Hz
   LP FILTER ................................................. 3KHz

4. Verify that the incidental AM is less than 1% as shown on the Modulation Analyzer.

5. Set Signal Generator frequency to 250MHz.

6. Set Modulation Analyzer Controls as follows:
   MEASUREMENT....................................... FM
   HP FILTER................................................ OFF
   LP FILTER ................................................. OFF

7. Set Signal Generator RF controls as given in the table below. Verify that the reading is below specified limits as displayed on Distortion Analyzer.

| SIGNAL GENERATOR CONTROLS PRESS | | | | | | UPPER LIMIT (%) |
|---|---|---|---|---|---|---|
| MOD FREQ | 20 | Hz | FM | .3 | MHz | 2.0 |
| MOD FREQ | .4 | KHz | FM | .3 | MHz | 2.0 |
| MOD FREQ | 1 | KHz | FM | .3 | MHz | 2.0 |
| MOD FREQ | 100 | KHz | FM | .3 | MHz | 2.0 |

***FM DEVIATION TEST***

DESCRIPTION: FM Deviation is measured using the Modulation Analyzer.

EQUIPMENT REQUIRED: Modulation Analyzer.
One TYPE N 50Ω cable.
One 50Ω BNC cable.

3 Connect Signal Generator RF output to Modulation Analyzer input using 50Ω Type N cable. Connect Signal Generator MOD OUTPUT to FM/∅M input using 50Ω BNC cable.

***FM DEVIATION TEST-Continued***

2. On Signal Generator,
   Press .......................................................... INSTR PRESET
   Set AMPTD to ............................................ +13dBm
   Press .......................................................... FM
   Press .......................................................... EXT DC
   Set MOD OUT to ........................................ 1V

3. Set Modulation Analyzer Controls as follows:
   Enter .......................................................... 41.0 SPCL
   MEASUREMENT........................................ FM

4. Set Signal Generator controls to values given in the table below. Verify that the AM reading is within specified limits as displayed on Modulation Analyzer.

| SIGNAL GENERATOR | | | MINIMUM |
|---|---|---|---|
| RF FREQ (MHz) | MOD FREQ (KHz) | FM (KHz) | FM (KHz) |
| 250.00 | 0.020 | 375 | 300.0 |
| 680.00 | 100.0 | 400 | 300.0 |

## 6-2. ADJUSTMENTS.

DESCRIPTION

There are no maintenance adjustments required after repair of the Signal Generator.

# SECTION VII. STORAGE AND SHIPMENT

## 7-1. ENVIRONMENT.

The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature ........................................ -55°C to +75°C
Humidity ........................................ 5% to 95% (maximum wet-bulb temperature = 40°C)
Altitude ........................................ 15, 300 meters (50,000 feet)

## 7-2. PACKAGING.

***Original Packaging.*** Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also mark the container FRAGILE to assure careful handling. In any correspondence refer to the instrument by model number and full serial number.

***Other Packaging.*** The following general instructions should be used for repackaging with commercially available materials:

1. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the service required, return address, model number, and full serial number.)
2. Use a strong shipping container. A double wall carton made of 2.4 MPa (350 psi) test material is adequate.
3. Use enough shock-absorbing material (75 to 100 mm layer, 3 to 4 in.) around all sides of the instrument to provide firm cushion and prevent movement in the container. Protect the front panel with cardboard.
4. Seal the shipping container securely.
5. Mark the shipping container FRAGILE to ensure careful handling.

# APPENDIX A
# REFERENCES

## A-1. SCOPE.

This appendix lists all forms, technical bulletins, technical manuals, and miscellaneous publications referenced in this manual.

## A-2. FORMS.

Discrepancy in shipment report (DISREP) .......... Form SF 361
Report of discrepancy (ROD) .......... Form SF 364
Quality deficiency report .......... Form SF 368
Recommended changes to equipment technical publications .......... DA Form 2028-2

## A-3. TECHNICAL MANUALS.

Organizational, direct support, and general support repair parts
and special tools list, Signal Generator SG-1207/U .......... TM 11-6625-3165-24P
Administrative storage procedures .......... TM 740-90-1
Procedures for destruction of electronics materiel to
prevent enemy use (Electronics Command) .......... TM 750-244-2

## A-4. MISCELLANEOUS.

The Army Maintenance Management System (TAMMS) .......... DA Pam 738-750
Consolidated index of Army publications and blank forms .......... DA Pam 310-1
First aid for soldiers .......... FM 21-11

# APPENDIX B
# MAINTENANCE ALLOCATION

## Section I. INTRODUCTION

**B-1. GENERAL.**

a. This appendix provides a general explanation of all maintenance and repair functions authorized at various maintenance categories for the SG-1207/U.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

**B-2. MAINTENANCE FUNCTIONS.** Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), preserve, drain, paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. Maintain or regulate within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine the cause and corrections to be made or adjusted on instruments or test measuring and diagnostic equipment used in precision measurement . This consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service on other maintenance functions. Install may be the act of emplacing, seating, of fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, and/or replace) including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to identify troubles restore serviceable to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item or system.

j. Overhaul. That periodic maintenance effort (service/ action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR) . Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/ actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/ components.

**B-3. EXPLANATION OF COLUMN IN THE MAC, SECTION II.**

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies and modules with the next higher assembly. End item group number shall be "00".

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn (s), the category of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time and quality assurance/ quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

C ........................................................................ Operator/ Crew
O ........................................................................ Organizational Maintenance
F......................................................................... Direct Support Maintenance
H ........................................................................ General Support Maintenance
L......................................................................... Specialized Repair Activity
D ........................................................................ Depot Maintenance

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

**B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.**

a. Column 1, Reference Code. The tool and test equipment code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

**B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.**

a. Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

# SECTION II. MAINTENANCE ALLOCATION CHART FOR SIGNAL GENERATOR SG-1207/U

| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY | | | | | (5) TOOLS AND EQPT. | (6) REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | | C | O | F | H | D | | |
| 00 | Signal Generator SG-1207/U HF 8624M | Inspect | | 0.1 | | | | 1 | A |
| | | Inspect | | | | 0.1 | | 2 | B |
| | | Test | | 0.2 | | | | 21,22 | C |
| | | Test | | | | 0.2 | | 2-8,16-20 23-42 | D |
| | | Calibrate | | | | 0.5 | | 2-15,18 | E |
| | | Repair | | 0.5 | | | | 1 | F |
| | | Repair | | | | 2.5 | | 2=45 | G |
| | | Repair | | | | | 0.5 | | H |
| 0001 | KEYBD/LCD/Display A1 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.5 | | | |
| | | Replace | | | | 0.5 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0002 | Modulation Module A2 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.5 | | | |
| | | Replace | | | | 0.5 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0003 | Processor/Memory Module A3 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.5 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0004 | Latch Module A4 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.5 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0005 | FM Loop/Counter/Time Base Module A6 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0006 | SAWR Loop Module A7 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0007 | IF Loop Module A9 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |

## SECTION II. MAINTENANCE ALLOCATION CHART FOR SIGNAL GENERATOR SG-1207/U-Continued

| (1) GROUP NUMBER | (2) COMPONENT ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE CATEGORY C | O | F | H | D | (5) TOOLS AND EQPT. | (6) REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 0008 | Reference Loop Module A11 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0009 | SUM Loop/Divider Module A12 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0010 | Output Filters/ALC Module A13 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | | |
| | | Replace | | | | 0.1 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0011 | Heterodyne MOD A14 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | | |
| | | Replace | | | | 0.2 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0012 | Power Supply REG/ Attenuator/Drivers Module A17 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | 2,3 | |
| | | Repair | | | | 0.1 | | 2 | K |
| | | Replace | | | | 0.5 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0013 | Power Supply RECT/ Filter Module A18 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | 2,3 | |
| | | Repair | | | | 0.1 | | 2 | L |
| | | Replace | | | | 0.5 | | 2 | |
| | | Repair | | | | | 0.5 | | J |
| 0014 | Doubler/Attenuator Module A19 | Inspect | | | | 0.1 | | 2 | |
| | | Test | | | | 0.3 | | 2,7,8 | |
| | | Replace | | | | 0.2 | | 2 | |
| | | Repair | | | | | 0.5 | | j |

## SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SIGNAL GENERATOR SG-1207/U

| TOOL OR TEST EQUIPMENT REF CODE | MAINTENANCE CATEGORY | NOMENCLATURE | NATIONAL/NATO STOCK NUMBER | TOOL NUMBER |
|---|---|---|---|---|
| 1 | O | Tool Kit, Electronic Equipment, TK-101/G | 5180-00-064-5178 | |
| 2 | H | Tool Kit, JTK-17 | 1931-01-073-3845 | |
| 3 | H | Digital Voltmeter | 6625-00-557-8305 | HP 3490A |
| 4 | H | Oscilloscope Mainframe MIS28706/1TYPE1 | 6625-01-046-3712 | TEK 5440 |
| 5 | H | Plug-In Oscilloscope MIS28706/5 | 4931-01-008-1478 | TEK 5S14N |
| 6 | H | Probe, 10:1 010-6056-03 | 6625-00-434-0605 | TEK P6056 |
| 7 | H | Power Meter MIS30525 | 6625-00-148-8069 | HP 432A |
| 8 | H | Thermistor Mount 7915907 | 4931-01-005-3865 | HP 478A |
| 9 | H | Attenuator, Set | 6695-01-111-2334 | WE-9918 |
| 10 | H | Spectrum Analyzer AN/USM-489(V) 1 | 6625-01-079-9495 | TEK492/1/ 2/3/21 |
| 11 | H | Pulse Generator MIS10355TYPE1 | 6625-01-103-9550 | HP 214B |
| 12 | H | Modulation Analyzer | 6625-01-081-4156 | HP 8901A |
| 13 | H | Distortion Analyzer 7911957 | 4931-00-987-9002 | HP 334A |
| 14 | H | Adapter, Connector UG-201A/U 10519457 | 5935-00-739-2243 | |
| 15 | H | BNC to Dual Banana Adapter 7912056-2 | 5915-01-071-8001 | POM 1656-2-60075ohm |

# SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SIGNAL GENERATOR SG-1207/U-Continued

| TOOL OR TEST EQUIPMENT REF CODE | MAINTENANCE CATEGORY | NOMENCLATURE | NATIONAL/NATO STOCK NUMBER | TOOL NUMBER |
|---|---|---|---|---|
| 16 | H | Frequency Measurement System MIS28754TYPE1 | 4931-01-040-0121 | HP 5345A System |
| 17 | H | Oscilloscope AN/USM-488 (or equivalent) | | TEK 2335A |
| 18 | H | Low Frequency Spectrum Analyzer (or equivalent) | 6625-01-118-9963 | HP 3585A |
| 19 | H | Digital Multimeter | 6625-01-073-9493 | JF 8020A |
| 20 | H | BD ASSY PS TEST CONN (or equivalent) | | 08642-80053 |
| 21 | O,H | Cable Assembly, 50Ω BNC-BNC 2 each 7907467 | 4931-00-196-0051 | POM BNC-C-30 |
| 22 | O,H | BNC Tee UG-274 | 5935-00-926-7523 | |
| 23 | H,D | Wrench (supplied) | | 08642-00070 |
| 24 | H,D | Post, Extractor (supplied) | | 08642-20041 |
| 25 | H,D | Cable Assembly, SMA-SMC (supplied) | | 08642-20082 |
| 26 | H,D | Extractor, Fuse (supplied) | | 08642-40073 |
| 27 | H,D | Cable Assembly, Flat (28480) (or equivalent) | | 08642-60959 |
| 28 | H,D | Cable Assembly, Long (28480) (or equivalent) | | 08662-60075 |
| 29 | H,D | Cable Assembly, Short (28480) (or equivalent) | | 08662-60080 |
| 30 | H,D | Adapter, (M) SMC to (M) SMC 4 each (28480) (or equivalent) | | 1250-0827 |
| 31 | H,D | Adapter, (F) BNC to (F) SMC 2 each (28480) (or equivalent) | | 1250-0832 |
| 32 | H,D | Adapter, (M) SMC Tee (28480) (or equivalent) | | 1250-0837 |

## SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SIGNAL GENERATOR SG-1207/U-Continued

| TOOL OR TEST EQUIPMENT REF CODE | MAINTENANCE CATEGORY | NOMENCLATURE | NATIONAL/NATO STOCK NUMBER | TOOL NUMBER |
|---|---|---|---|---|
| 33 | H,D | Adapter, (M) SMA to (F) SMC 2 each (28480) (or equivalent) | | 1250-1697 |
| 34 | H,D | Adapter, 50 Pin Test Connector (28480) (or equivalent) | | 1251-5653 |
| 35 | H,D | Adapter, 16 Pin Test Connector (28480) (or equivalent) | | 1251-8105 |
| 36 | H,D | Adapter, 26 Pin Test Connector (28480) (or equivalent) | | 1251-8248 |
| 37 | H,D | Adapter, 34 Pin Test Connector (28480) (or equivalent) | | 1251-8601 |
| 38 | H,D | Adapter, 20 Pin Test Connector (28480) (or equivalent) | | 1251-8812 |
| 39 | H,D | Adapter, 14 Pin Test Connector (28480) (or equivalent) | | 1251-8823 |
| 40 | H,D | Adapter, 10 Pin Test Connector (28480) (or equivalent) | | 1252-0153 |
| 41 | H,D | Adapter, Binding Post (28480) (or equivalent) | | 5021-0844 |
| 42 | H,D | Test Lead Kit (28480) (or equivalent) | | 34118A |
| 43 | H,D | Tool, Torx Drive (supplied) (28480) | | 8710-1378 |
| 44 | H,D | Tool, Torx Drive (supplied) (28480) | | 8710-1524 |
| 45 | H,D | Tool, Torx Drive (28480) (or equivalent) | | 8710-1541 |

## SECTION IV. REMARKS FOR

## Signal Generator SG-1207/ U

| REFERENCE CODE | REMARKS |
|---|---|
| A | External visual inspection. |
| B | Visual external and internal inspection for signs of damage, loose parts, or cables, ETC. |
| C | Operational tests and observation of error messages. |
| D | Fault isolate to major assembly or cables. |
| E | Calibration performed using technical bulletin listed in TB 43-180. |
| F | Repair by replacement of fuse, knobs, handles, feet, rear panel standoffs, and power cable which are nonrepairable items. |
| G | Repair includes replacement of AS Power Supply Control Assembly, A10 Line Power Assembly, A15 HP-IB Connector Assembly, A20 Calibration Data Module, A21 Rotary Pulse Generator Assembly, B1 Fan Assembly, T1 Transformer, W1-W34, W36, W38, W300, and W301 inter-assembly cables, and panel mounted connectors which are nonrepairable items. |
| H | To be returned to Contractor for repair only in the event that TSG is unable to repair the SG-1207/U either due to a lack of parts or time factor. Time indicated is allotment for DEPOT to ship defective SG-1207/U to contractor service center for repair. |
| J | To be returned to Contractor for repair. Time indicated is allotment for DEPOT to ship defective module to contractor service center for repair. |
| K | Repair limited to replacement of fuse A17F1. |
| L | Repair limited to replacement of fuses A18F1-A18F5. |

# APPENDIX C
# AMPLITUDE UNITS CONVERSION

## C-1. GENERAL.

You can use this information to convert the output amplitude to practically any desired units. This information might be useful, for example, to convert between dBm and volts or EMF mF and dBm or dB EMF µV to EMF µF.

Observe the following three considerations sequentially when converting amplitude units:

1. When you desire non-EMF units and the EMF mode is currently selected, turn off the EMF mode by selecting EMF (SHIFT INCR SET) OFF ON (HP-IB code: EMOF). If you desire EMF units, then do nothing at this point.

2. Use the following table to determine the keystrokes or HP-IB codes that will convert to the amplitude units in the left column of the table.

3. When you desire EMF units and the EMF mode is currently off, turn on the EMF mode by selecting EMF (SHIFT INCR SET) OFF ON (HP-IB code: EMON).

*To convert amplitude values manually, use the following conversion formulas:*

| | | |
|---|---|---|
| dBm | = | dBm |
| dBf | = | dBm + 120.0 |
| dB V | = | dBm - 13.0 |
| dB mV | = | dBm + 47.0 |
| dB ClV | = | dBm + 107.0 |
| dB EMF V | = | dBm - 7.0 |
| dB EMF mV | = | dBm + 53.0 |
| dB EMF µV | = | dBm + 113.0 |
| V | = | 10(dBm- 13.0)/20 |
| mV | = | 10(dBm + 47.0)/20 |
| JIV | = | 10(dBm + 107.0)/20 |
| EMF V | = | 10(dBm - 7.0)/20 |
| EMF mV | = | 10(dBm + 53.0)/20 |
| EMF µV | = | 10(dBm + 113.0)/20 |

| To Select The Following Units: | Select the Following: | |
|---|---|---|
| | **Keys** | **HP-IB Codes** |
| dBm[1] | [MHz V] [GHz dBm]<br>or<br>[AMPTD] [SHIFT] [REF SET FREQ] [0] [GHz dBm] [AMPTD] [REL OFF OFF ON] | VL DM<br>or<br>APRS 0 DM APR0 |
| V, mV, or $\mu$V; or EMF V, EMF mV, or EMF $\mu$V | [MHz V] or [kHz mV] or [Hz $\mu$V] | VL |
| dB$\mu$V[2] or dB EMF $\mu$V[2] | [dB$\mu$V rad %] or [AMPTD] [SHIFT] [REF SET FREQ] [1] [Hz $\mu$V] | DU or APRS 1 UV |
| dBf | [AMPTD] [SHIFT] [REF SET FREQ] [−] [1] [2] [0] [GHz dBm] | APRS −120 DM |
| dBW | [AMPTD] [SHIFT] [REF SET FREQ] [3] [0] [GHz dBm] | APRS 30 DM |
| dBV<br>dB EMF V | [AMPTD] [SHIFT] [REF SET FREQ] [1] [MHz V] | APRS 1 VL |
| dB mV<br>dB EMF mV | [AMPTD] [SHIFT] [REF SET FREQ] [1] [kHz mV] | APRS 1 MV |
| dB REL<br>dB EMF REL | Refer to **Relative Amplitude** | |

[1]If operating below −127.0 dBm, up to a 0.2 dB change could occur. To ensure no level change occurs, use the second sequence provided.

[2]To ensure that message "AMPTD REF SET to 1.00UV .C2" will not occur, use the second sequence provided.

# GLOSSARY

| | |
|---|---|
| absolute units | In the 8642, absolute units are units that can be set directly without using the relative amplitude mode. These include dBm, V, mV, µV, EMF, V, EMF mV, and EMF µV. |
| active function | When a function is active, you do not need to select the function's key before changing its value with either the Knob, or Step or Data keys, or the Off/On key. A function is usually indicated as active when the cursor in the display is above that function's value. For example, if the cursor is over the RF frequency value, you can enter a new frequency value or use the Knob or Step keys to change the value. You do not need to press the FREQ key each time a change is desired. |
| active function prefix | Many HP-IB codes should not be entered without being prefixed by an active function code. For a list of the active function codes and the codes that should be prefixed with an active function code, refer to HP-IB Operation in Section I. |
| alphanumeric | The 8642 has an alphanumeric display; that is, the display can show both alphabetic and numeric characters. |
| ASCII | ASCII is an abbreviation for American Standard Code for Information Interchange (pronounced "ask-ee"). |
| Calibration | When a module is replaced in the HP 8642, the instrument is recalibrated by down loading the calibration data provided for the replacement module into the instrument. (No manual adjustments or additional test equipment is necessary.) |
| Calibration Data | Control data created for an individual module which enables it to meet all of its performance standards (some modules do not require calibration data for their operation). |
| cursor | The cursor is the triangular segment above an alphanumeric character in the display. The cursor usually designates the active function and the resolution of the Knob. Cursors also indicate the status of Knob Hold and Knob Increment. |
| Down-load | Refers to the transfer of calibration data from an A20 Calibration Module to the instrument. |

| | |
|---|---|
| function | A function refers to each capability of the 8642. Key functions are labeled directly on the key that accessed the function; frequency (FREQ) and amplitude (AMPTD) are both key functions.<br>Shift key functions are labeled in blue above the key that accesses the function (for example, REF SET and REL ZERO). You can access a shift key function by first pressing the blue SHIFT key (which causes the display to show "SHIFT") and then the key under the blue label. (HP-IB: each shift key function has an individual HP-IB code and should not be preceded by a shift code.)<br>Special functions can be selected by pressing SPCL (SHIFT -), and then by keying in the code number of the desired special function. |
| Instrument Level Diagnostics (ILD) | Comprehensive testing designed to check the over-all operation of the instrument. |
| last-selected value | A function's last-selected value usually can be toggled on with the OFF ON key. |
| Module | An electrical assembly within the HP 8642 which can be replaced on-site; that is, those assemblies contained in the On-site Service Kit. |
| Module Level Diagnostics (MLD) | Module specific test routines designed to fully interrogate the operation of a module. |
| Module Swap Principle | States that when individual modules that have been calibrated and tested to meet their own input and output performance standards are connected in an instrument, the instrument can also be considered fully calibrated and capable of meeting all of its performance specifications. This principle has been validated by comprehensive testing during development of the HP 8642. |
| On-site | The location of the instrument when in normal operation. |
| power up | When the instrument is powered up, it goes through a sequence of internal checks. |
| queued up | A queued up list is a list of messages that can be accessed when the MSSG key is pressed again and again. The MSSG annunciator will indicate when a message is queued up for display. |
| RQS | RQS (request service) is from the Signal Generator's point of view. The request service (RQS) bit is in the 8642 Status Byte. This bit affects when the service request (SRQ) line is pulled on the HP-IB interface. |

| | |
|---|---|
| scroll | Scrolling through the Help function list lets you view the description and code number of each Special Function. You can scroll through the message list by repeatedly selecting the MSSG key. |
| SRQ | SRQ is from the HP-IB controller's point of view. The service request (SRQ) line is a signal line on the HP-IB interface. This line is pulled low by the Signal Generator when it is requesting service.<br>The SRQ annunciator in the display of the 8642 indicates that this Signal Generator is pulling the HP-IB SRQ line low. |
| Substitution (module) | The process of connecting a known good substitute module into the circuit in order to by-pass a suspect module. |
| Task Sequence Diagrams | Inference diagrams designed to provide the user with a systematic approach to testing. Each diagram consists of Task Arrows (indicating the task to be performed), Result Blocks (describing each possible test result condition), and Gotogons (used when necessary to direct the user to some other location in the manual). |
| Up-load | Refers to the transfer of calibration data from the instrument to the A20 Calibration Module. |
| Verification | a) Testing done to determine the integrity of a specified portion of circuitry.<br>b) Post repair testing to confirm that the failure detected prior to the repair has been eliminated. |

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